TM 8-6515-010-14&P

TECHNICAL MANUAL

OPERATOR, UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

SURGICAL UNIT, ARTHROSCOPIC

6515-01-318-1558

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1999

SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

Do not try to pull or grab the individual.

If possible, turn off the electrical power.

If you cannot turn off the electrical power, pull, push, or lift the person to safety using a dry wooden pole or a dry rope, or some other insulating material.

Send for help as soon as possible.

After the injured person is free of contact with the source of electrical shock, move the person a short distance away and immediately start artificial resuscitation.

Throughout this manual are WARNINGS, CAUTIONS, and NOTES. Please take time to read these. They are there to protect you and the equipment.

WARNING

Procedures which must be observed to avoid personal injury, and even loss of life.

CAUTION

Procedures which must be observed to avoid damage to equipment, destruction of equipment, or long-term health hazards.

NOTE

Essential information that should be remembered.

ELECTRICAL AND ELECTRONIC HAZARDS

» Severe injury or death can result when any part of your body comes in contact with live electrical circuits. Medical Equipment Repairers must be especially alert to the dangers of exposed circuits, terminals, power panels, and the like.

» The electrical parameter that injures and kills is CURRENT; the force that caused current to flow is called VOLTAGE. Voltage ratings are normally assigned to live electrical circuits, power supplies, and transmission lines. You should consider all voltages of 30 or more to be hazardous.

» The physiological effect of current flowing through the human body is related to the following factors:

- The path of the current through the body.
- The magnitude of the current.
- The duration of the voltage shock or discharge that causes current flow.
- The frequency of the voltage if alternating current.
- The susceptibility of damage to your heart from the current and from repeated shocks.

» Alternating current tends to concentrate near the body's surface because of the phenomenon of "skin effect." The higher the frequency of the alternating current voltage source, the more likely the current will tend to flow in or near the skin and away from internal body organs.

» The effect of current becomes more severe with the length of time that it flows through the body; a prolonged current flow can cause severe internal burns, collapse, unconsciousness, or death.

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WASHINGTON, DC

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You can help improve this manual. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your memorandum, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 (Recommended Changes to Equipment Technical Publications) located in the back of this manual, to: U.S. Army Medical Army Medical Materiel Agency, 1423 Sultan Drive, Suite 100, ATTN: MCMR-MMM, Fort Detrick, MD 21702-5001. A reply will be furnished directly to you.

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HOW TO USE THIS MANUAL

This manual provides all the information needed to understand the capabilities, functions, and characteristics of this equipment. It describes how to set up, operate, test, and repair the equipment. You must familiarize yourself with the entire manual before operating or beginning a maintenance task.

The manual is arranged by chapters, sections, and paragraphs followed by appendixes, a glossary, an index, and DA Forms 2028-2. Use the table of contents to help locate the chapter or section for the general subject area needed. The index will help locate more specific subjects.

Multiple figures and tables are provided for your ease in using this manual. Words that are both capitalized and in bold are names of components or words that you will actually see on the equipment.

Chapter 3 provides a systematic method of inspecting and servicing the equipment. In this way, small defects can be detected early before they become a major problem causing the equipment to fail. Make a habit of doing the checks and services in the same order each time and anything wrong will be detected quickly.

Only perform maintenance functions specified in the maintenance allocation chart for your level of maintenance. Maintenance functions specified for higher levels of maintenance frequently require additional training; test, measurement, and diagnostic equipment; or tools.

CHAPTER 1

INTRODUCTION

Section 1. GENERAL INFORMATION

1-1. Overview.

This manual describes the surgical unit, arthroscopic (fig 1-1); provides equipment technical data; and provides operational and maintenance functions, services, and actions. Additional information follows:

a. Type of manual. Unit, direct support (DS), and general support (GS) maintenance (including repair parts and special tools list).

b. Model number and equipment name. Surgical Unit, Arthroscopic.

c. Purpose of equipment.

(1) To resect damaged tissue and remove extraneous matter found in articular body cavities.

(2) To repair tears and other defects, shave away debris, and perform appropriate synovectomy procedures.

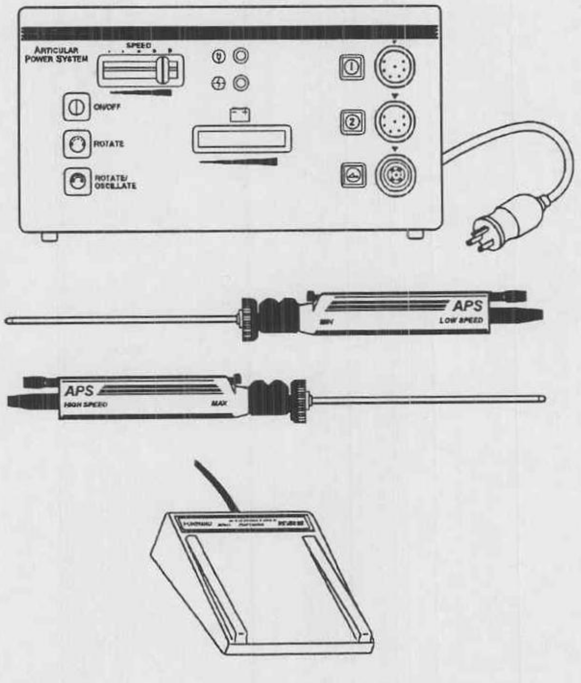


Figure 1-1. Surgical unit, arthroscopic.

1-2. Explanation of abbreviations and terms.

Special or unique abbreviations, acronyms, and terms used in this manual are explained in the glossary.

1-3. Maintenance forms, records, and reports.

TB 38-750-2 prescribes forms, records, reports, and procedures.

1-4. Destruction of Army materiel to prevent enemy use.

AR 40-61 contains instructions for destruction and disposal of Army medical materiel. Also, the SB 8-75 series provides periodic information and/or instructions on the destruction of medical materiel.

1-5. Administrative storage.

a. Place the arthroscopic surgical unit in administrative storage for only short periods of time when a shortage of maintenance effort exists. This equipment should be in mission readiness condition within 24 hours or within the time factors determined by the directing authority. During the storage period, keep appropriate maintenance records.

b. Perform preventive maintenance checks and services (PMCS) listed in the operator PMCS table and the repairer PMCS table before placing Army equipment in administrative storage. When equipment is removed from storage, perform PMCS to ensure its operational readiness.

c. Inside storage is preferred for equipment selected for administrative storage.

1-6. Preparation for storage or shipment.

Procedures to prepare the arthroscopic surgical unit for storing or shipping are listed in chapter 3, section XI.

1-7. Quality control (QC).

AR 702-18/DLAR 4155.37/NAVSUPINST 4410.56/AFR 69-10/MCO 4450.13 contains QC requirements and procedures.

1-8. Nomenclature cross-reference list.

Table 1-1 identifies official versus commonly used nomenclatures.

Table 1-1. Nomenclature cross-reference list.

Common name	*Official nomenclature*
Articular power system (APS)	Surgical Unit, Arthroscopic

1-9. Reporting and processing medical materiel complaints and/or quality improvement reports.

AR 40-61 prescribes procedures for submitting medical materiel complaints and/or quality improvement reports for the APS.

1-10. Warranty information.

A warranty is not applicable.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-11. Equipment characteristics, capabilities, and features.

a. The APS is a self-contained portable surgical system designed for use in a controlled environment.

b. The APS is either battery or line voltage powered.

c. A fixed-voltage transformer is furnished so that the APS can be operated on a 230-volt source of electrical power.

d. The APS console contains three colored charge level indicators. The battery cannot be over-charged.

e. The APS includes a carrying case and a reusable shipping container.

1-12. Component and accessory descriptions.

a. Components.

(1) *Footswitch (fig 1-2).*The footswitch can be used to control the operation of a handpiece when the footswitch selector switch is activated on the APS console. When the footswitch is selected, the APS console indicator illuminates.

(2) *High speed handpiece (fig 1-3).* The high speed handpiece is used when its application requires tool speeds between 300 and 1,050 revolutions per minute (rpm) and average output torque of 10 inches/ounce.

(3) *Low speed handpiece (fig 1-4).* The low speed handpiece is used in applications requiring tool speeds between 150 and 300 rpm and average output torque of 40 inches/ounce.

(4) *Electrical power cable assembly.* This assembly is used to connect the APS console to a wall receptacle.

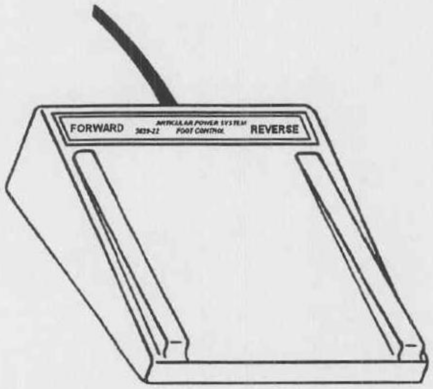


Figure 1-2. Footswitch.

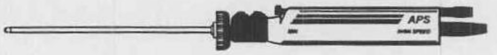


Figure 1-3. High speed handpiece.

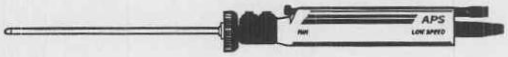


Figure 1-4. Low speed handpiece.

b. Accessories.

(1) *Shipping case (fig 1-5).* The large, hinged case with foam cutouts is used for shipping the APS with all components and accessories.

(2) *Sterilization case (fig 1-6).* The stainless steel sterilization case consists of the base section and a lid. Both the base section and lid are perforated to allow steam to circulate around the accessories being sterilized in the case.

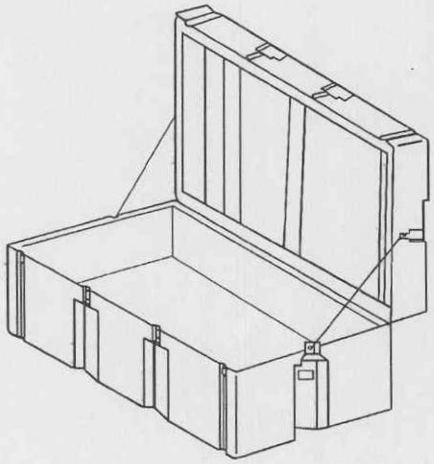


Figure 1-5. Shipping case.

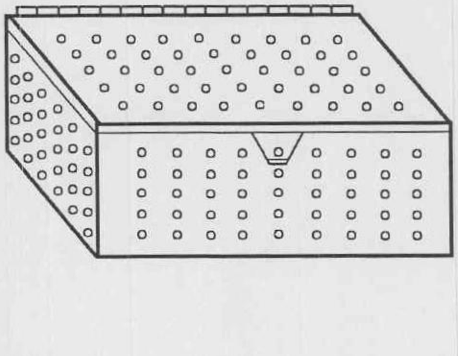


Figure 1-6. Sterilization case.

(3) *Transformer (fig 1-7).* The step-down transformer is required for operation of the APS on 230 volts.

(4) *Carrying case (fig 1-8).*The carrying case is used to transport the APS, components, and a few accessories inside a field hospital environment.

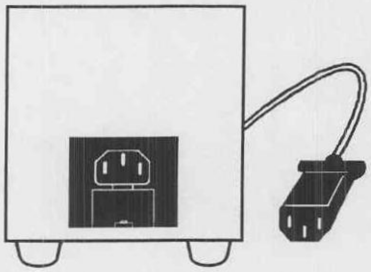


Figure 1-7. Transformer.

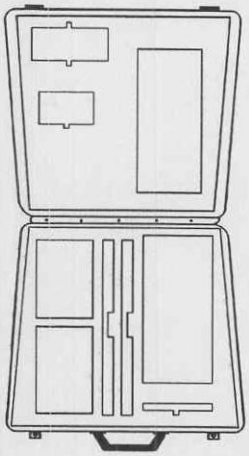


Figure 1-8. Carrying case.

(5) *Cutters/burs.* Cutters/burs of varying sizes, shapes, and purposes are provided to support surgical requirements.

(6) *Cannulas.* The cannulas, which are small tubes of multiple sizes, are used for insertion into vessels or body cavities during the treatment of patients.

(7) *Brushes.* Specialized brushes are provided to aid in cleaning of the APS.

(8) *Keys.* A set of two keys is provided to lock the carrying case.

1-13. Tabulated data, decals, and data plates.

The tabulated data provides miscellaneous characteristics, specifications, and other information for the APS.

a. Miscellaneous characteristics and specifications. Tables 1-2 and 1-3 provide a broad range of miscellaneous characteristics and specifications unique to the APS.

Table 1-2. Miscellaneous characteristics.

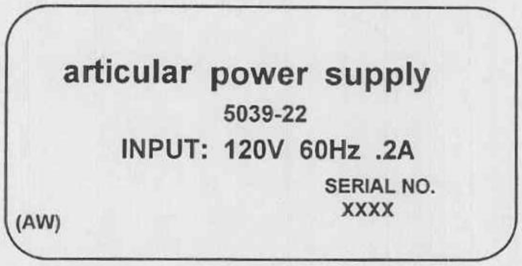
Low speed handpiece	
Standard operating speed	150 to 300 rpm
Average output torque	40 in/oz
Handpiece weight	170.09 g (6 oz)
Handpiece length	15.24 cm (6 in)
High speed handpiece	
Standard operating speed	300 to 1,050 rpm
Average output torque	10 in/oz
Handpiece weight	170.09 g (6 oz)
Handpiece length	15.24 cm (6 in)

Table 1-3. Specifications.

Voltages/frequencies	105 - 130 VAC, 50/60 Hz or 230 VAC, 50/60 Hz
Dimensions	
Height	18.10 cm (7.125 in)
Width	32.40 cm (12.750 in)
Depth	17.46 cm (6.875 in)
Weight	5.02 kg (11 lb, 1 oz)

b. Identification, instruction, and warning plates, decals, or markings.

(1) The manufacturer data plate (located on the back of the APS module) is depicted in figure 1-9.



articular power supply

5039-22

INPUT: 120V 60Hz .2A

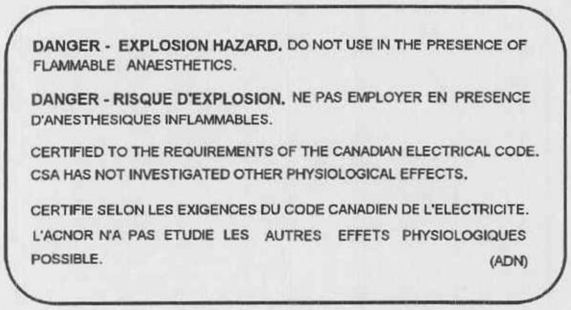
SERIAL NO.
XXXX

(AW)

Figure 1-9. Manufacturer data plate.

(2) A hazard decal (located on the back of the APS module) providing hazard information is depicted in figure 1-10.

(3) A decal (located on the back of the APS module) providing information about the fuse is depicted in figure 1-11.



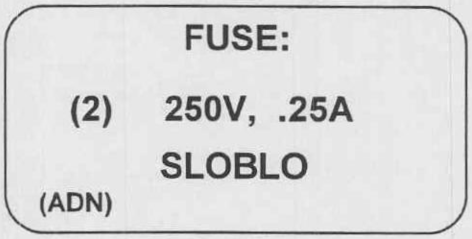
DANGER - EXPLOSION HAZARD. DO NOT USE IN THE PRESENCE OF FLAMMABLE ANAESTHETICS.

DANGER - RISQUE D'EXPLOSION. NE PAS EMPLOYER EN PRESENCE D'ANESTHESIQUES INFLAMMABLES.

CERTIFIED TO THE REQUIREMENTS OF THE CANADIAN ELECTRICAL CODE. CSA HAS NOT INVESTIGATED OTHER PHYSIOLOGICAL EFFECTS.

CERTIFIE SELON LES EXIGENCES DU CODE CANADIEN DE L'ELECTRICITE. L'ACNOR N'A PAS ETUDIE LES AUTRES EFFETS PHYSIOLOGIQUES POSSIBLE. (ADN)

Figure 1-10. Hazard decal.



FUSE:

(2) 250V, .25A

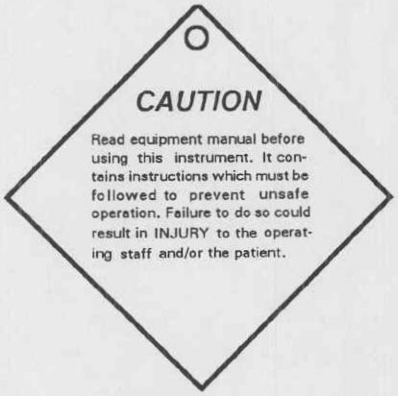
SLOBLO

(ADN)

Figure 1-11. Fuse decal.

(4) A caution tag (fastened on the back of the APS) providing information about the use of the APS is depicted in figure 1-12.

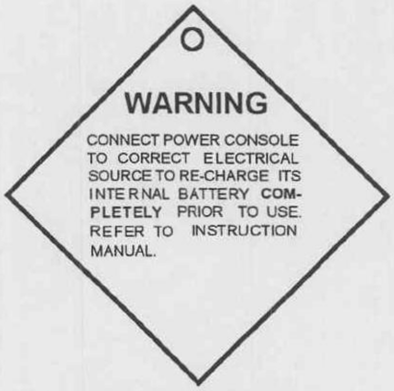
(5) A warning tag (fastened on the back of the APS) providing information about the use of electrical power is depicted in figure 1-13.



CAUTION

Read equipment manual before using this instrument. It contains instructions which must be followed to prevent unsafe operation. Failure to do so could result in INJURY to the operating staff and/or the patient.

Figure 1-12. Caution tag.



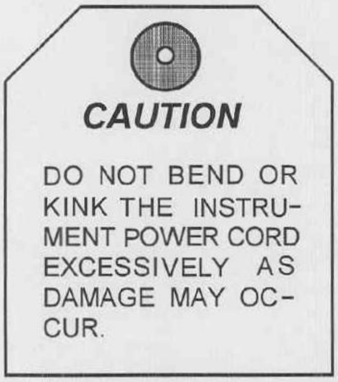
WARNING

CONNECT POWER CONSOLE TO CORRECT ELECTRICAL SOURCE TO RE-CHARGE ITS INTERNAL BATTERY **COMPLETELY** PRIOR TO USE. REFER TO INSTRUCTION MANUAL.

Figure 1-13. Warning tag.

(6) A caution tag (tied to the low speed handpiece cable and the high speed handpiece cable) is depicted in figure 1-14.

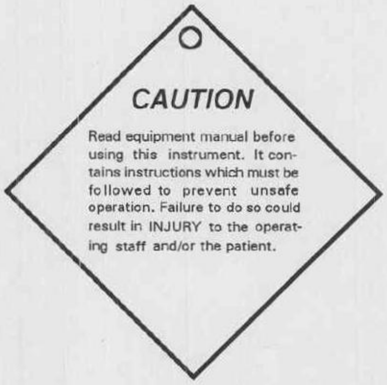
(7) A diamond shaped caution tag (tied to the low speed handpiece cable and the high speed handpiece cable) is depicted in figure 1-15.



CAUTION

DO NOT BEND OR KINK THE INSTRUMENT POWER CORD EXCESSIVELY AS DAMAGE MAY OCCUR.

Figure 1-14. Caution tag (low and high speed handpiece).



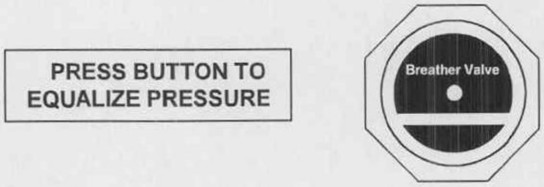
CAUTION

Read equipment manual before using this instrument. It contains instructions which must be followed to prevent unsafe operation. Failure to do so could result in INJURY to the operating staff and/or the patient.

Figure 1-15. Diamond shaped caution tag (low and high speed handpiece).

(8) A label (located on the front side of the shipping case next to the pressure relief valve) is depicted in figure 1-16.

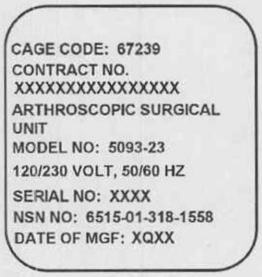
(9) A case manufacturer data plate (located on the front side of the shipping case) is depicted in figure 1-17.



PRESS BUTTON TO EQUALIZE PRESSURE

Breather Valve

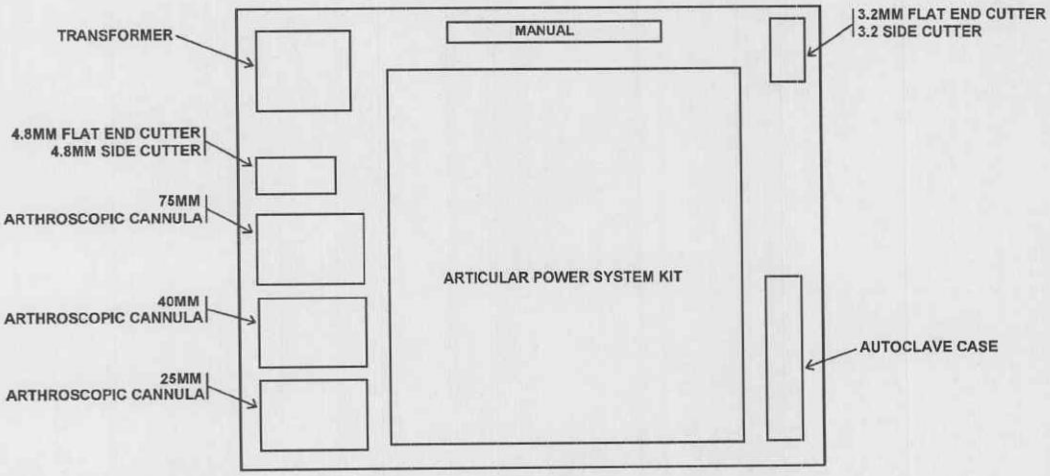
Figure 1-16. Pressure relief valve label.



CAGE CODE: 67239
CONTRACT NO.
XXXXXXXXXXXXXXXX
ARTHROSCOPIC SURGICAL UNIT
MODEL NO: 5093-23
120/230 VOLT, 50/60 HZ
SERIAL NO: XXXX
NSN NO: 6515-01-318-1558
DATE OF MGF: XQXX

Figure 1-17. Case manufacturer data plate.

(10) A laminated packing illustration (located on the lid of the shipping case) is depicted in figure 1-18.



TRANSFORMER
MANUAL
3.2MM FLAT END CUTTER
3.2 SIDE CUTTER
4.8MM FLAT END CUTTER
4.8MM SIDE CUTTER
75MM ARTHROSCOPIC CANNULA
ARTICULAR POWER SYSTEM KIT
40MM ARTHROSCOPIC CANNULA
AUTOCLAVE CASE
25MM ARTHROSCOPIC CANNULA

Figure 1-18. Laminated packing illustration.

(11) A decal (located on the top of the transformer) is depicted in figure 1-19.

(12) A metal plate (located on the lid of the sterilization case) is depicted in figure 1-20.

OUTPUT
AC 110V

APS
AC POWER CONVERTER
FOR USE WITH 5039-22
ARTICULAR POWER SUPPLY

WARNING: RISK OF FIRE,
REPLACE FUSES AS MARKED
AGC, 1/4A, 250V

INPUT
AC 220V 50/60 Hz

Figure 1-19. Transformer decal.

autoclave case
5052-12

Figure 1-20. Sterilization metal plate.

1-14. Model differences.

Model differences are not applicable since this manual covers a single model.

1-15. Safety, care, and handling.

a. Observe each WARNING, CAUTION, and NOTE in this manual.

b. Read the operating instructions in this manual before operating the unit. Refer servicing to qualified Medical Equipment Repairer personnel.

c. Eye protection is recommended when using the APS.

d. Inspect the APS handpieces, arthroscopic cutters and burs, and the APS module prior to each use.

e. Do not use either the low speed or high speed APS handpieces in the presence of flammable anesthetics. An explosion hazard is possible.

f. Ensure that cutters and burs are correctly inserted and seated into the handpiece.

g. Do not begin a surgical procedure if the battery charge indicator light is in the last two yellow or red zones.

h. Never immerge the APS console into any solution or sterilize it by any method.

i. Always store the APS console in the **OFF** position when not in use or battery discharge will occur.

j. Do not expose the APS console to temperature extremes (refer to para 2-16).

k. Do not bend or kink the handpiece power cord.

NOTE

Connecting the APS console into an electrical wall receptacle during surgery will allow for operating and charging the battery.

CHAPTER 2

OPERATING INFORMATION AND INSTRUCTIONS

Section I. PREPARATION FOR OPERATION

2-1. Scope.

This manual is primarily intended to provide information, instructions, and procedures for the maintenance of the APS. The operating information and instructions, while valid, do not provide sufficient information for use of the APS on a patient. Only qualified surgeons are trained in specific surgical techniques and procedures.

2-2. Unpacking the unit.

a. Depress the pressure relief valve on the shipping case.

b. Twist and open the latches on the front and two sides of the shipping case.

c. Open the lid and remove the APS carrying case. Place the APS on a flat working surface.

d. Open the APS carrying case.

e. Inventory the components and accessories. Items and quantities are as follows:

(1) APS console, 1 each.
(2) High speed handpiece, 1 each.
(3) Low speed handpiece, 1 each.
(4) Footswitch, 1 each.
(5) Cannula, arthroscopic, 25 mm, 6 each. (Located in cutout in lid of carrying case.)
(6) Keys, 2 each.
(7) Case, plastic, 1 each. (Holds aspiration cleaning brush, drive brush, and replacement aspiration lever.)
(8) Cannula, 25 mm, 2 boxes (5 per box).
(9) Cannula, 40 mm, 2 boxes (5 per box).
(10) Cannula, 75mm, 2 boxes (5 per box).
(11) Transformer, 1 each.
(12) Sterilization case, 1 each.
(13) Cutter, arthroscopic, 4.8 mm, 6 each.
(14) Cutter, arthroscopic flat end, 3.2 mm, 3 each.
(15) Cutter, arthroscopic, side cutter, 3.2 mm, 6 each.

2-3. Assembly.

a. Set the APS console on a flat and sturdy working surface near an electrical wall receptacle.

b. Connect the female end of the electrical power cable assembly into the recessed male receptacle (fig 2-1) in the back of the APS module. Then, insert the male connector of the electrical power cable assembly into a convenient electrical wall receptacle.

c. The step-down transformer should be used if the wall electrical power receptacle is supplying 220 to 230 volts.

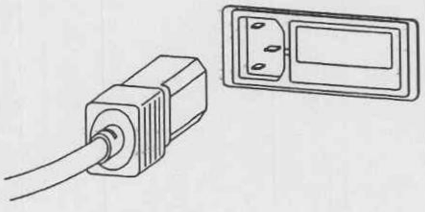


Figure 2-1. Recessed male receptacle.

The short cable from the transformer should be connected to the recessed male receptacle in the back of the APS module. Then the long transformer cable should be connected to the wall receptacle.

NOTE

> Because of the varying configurations of connectors and wall receptacles, there is no connector provided on the transformer electrical power cable.

Section II. OPERATING INFORMATION

2-4. APS controls, indicators, and receptacles (fig 2-2).

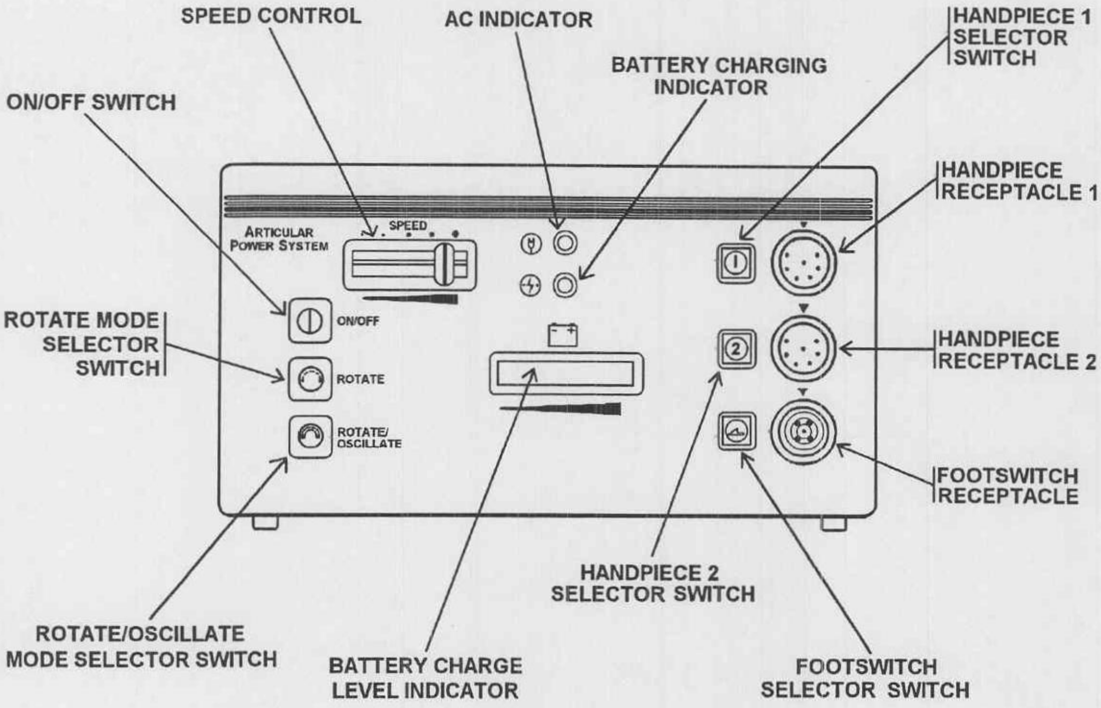

SPEED CONTROL
AC INDICATOR
BATTERY CHARGING INDICATOR
HANDPIECE 1 SELECTOR SWITCH
ON/OFF SWITCH
HANDPIECE RECEPTACLE 1
ARTICULAR POWER SYSTEM
SPEED
ON/OFF
ROTATE MODE SELECTOR SWITCH
ROTATE
HANDPIECE RECEPTACLE 2
ROTATE/ OSCILLATE
FOOTSWITCH RECEPTACLE
HANDPIECE 2 SELECTOR SWITCH
ROTATE/OSCILLATE MODE SELECTOR SWITCH
BATTERY CHARGE LEVEL INDICATOR
FOOTSWITCH SELECTOR SWITCH

Figure 2-2. APS controls, indicators, and receptacles.

a. Battery charging indicator. This red light emitting diode (LED) indicator illuminates when the battery is being charged.

b. Handpiece 1 selector switch. This pushbutton switch is used to activate handpiece **1**. The switch is illuminated when activated. Only one handpiece can be activated at a time.

c. Handpiece receptacle 1. This receptacle is for connecting a handpiece which will be controlled through the handpiece 1 selector switch.

d. Handpiece receptacle 2. This receptacle is for connecting a handpiece which will be controlled through the handpiece 2 selector switch.

e. Footswitch receptacle. This receptacle is for connecting the footswitch which will be controlled through the footswitch selector switch.

f. Footswitch selector switch. This pushbutton switch is used to select the footswitch method of controlling operation of the handpiece. The switch illuminates when selected. The footswitch, when active, deactivates the fingertip controls on the handpiece.

g. Handpiece 2 selector switch. This pushbutton switch is used to activate handpiece **2**. The switch is illuminated when activated. Only one handpiece can be activated at a time.

h. Battery charge level indicator. This indicator is a multi-colored LED bar display to indicate the level of battery charge

i. ROTATE/OSCILLATE mode selector switch. This pushbutton switch is used to select the rotate/oscillate mode of operation. The switch is illuminated when this mode is activated.

j. ROTATE mode selector switch. This pushbutton switch is used to select a single direction of the handpiece. The switch is illuminated when this mode is active.

k. ON/OFF switch. This lighted pushbutton switch is used to activate the APS by depressing it. Depressing the switch again will deactivate it.

l. SPEED control. This slide switch control is used to select the handpiece speed.

m. AC indicator. This red LED indicator illuminates when the unit is connected to electrical power.

2-5. Handpiece controls and connections (fig 2-3).

a. Control pad. The control pad contains two rubberized fingertip control switches. The operation of the switches are explained in the operating modes table 2-1.

b. Window positioning collar. This is a rotating collar which allows the open window of a cutter to be positioned relative to the control pad of the handpiece.

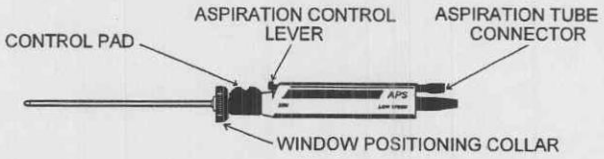


Figure 2-3. Handpiece controls and connections.

c. Aspiration control lever. This mechanical lever is used to control the amount of aspiration (suction) applied to the cutter.

d. Aspiration tube connector. This is a simple tube connector that channels the flow of saline and tissue removed by aspiration from the patient to the APS module.

Table 2-1. Operating modes.

Desired Function	***Mode Selector***	***Control Pad Position***
Forward	Forward/Reverse	Front Pad
Reverse	Forward/Reverse	Rear Pad
Oscillate	Oscillate	Oscillate
Oscillate	Oscillate	Oscillate

Section III. OPERATING INSTRUCTIONS

2-6. Cutters and burs.

a. Align a cutter and bur drive coupling with the receptacle on the handpiece as illustrated in figure 2-4, making sure the key portion of the cutter/bur is placed into any of the four slots.

b. Firmly insert the cutter/bur with a push/twist motion. Refer to figure 2-5.

c. Ensure that the location key on the cutter/bur shaft is securely engaged into the key receptacle on the handpiece. Gently pull on the cutter/bur to ensure that it is securely affixed as illustrated in figure 2-6.

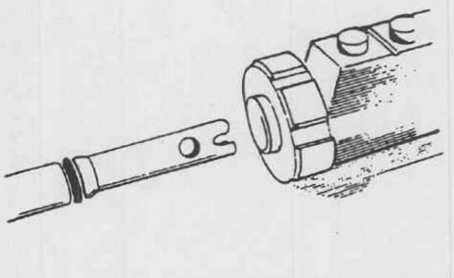


Figure 2-4. Cutter/bur receptacle alignment.

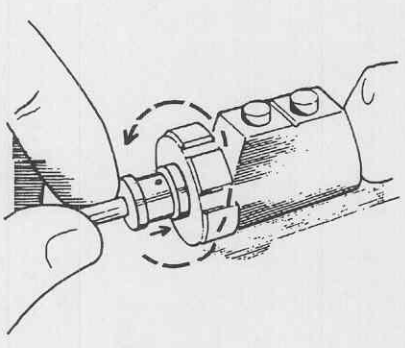


Figure 2-5. Cutter/bur insertion.

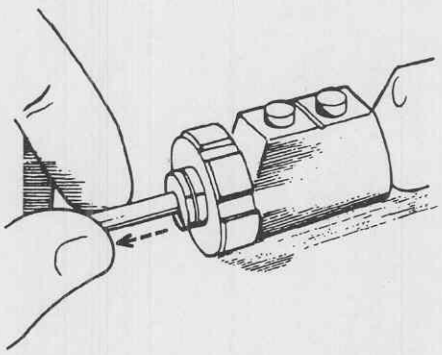


Figure 2-6. Cutter/bur insertion check.

2-7. Handpiece connection.

a. Select either the **1** or **2** handpiece receptacle. Then, align the arrow on the handpiece connector with the arrow on the APS console. Refer to figure 2-7.

b. Push inward on the handpiece connector until it is firmly seated. Refer to figure 2-8.

NOTE

Both handpieces can be connected to the APS module, but only one handpiece will operate at a time.

c. Cutters furnished with the unit are illustrated in figure 2-9.

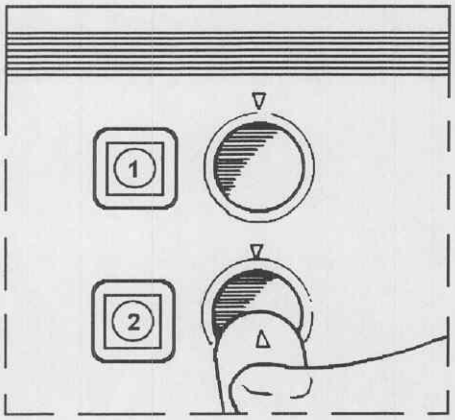


Figure 2-7. Handpiece connector alignment.

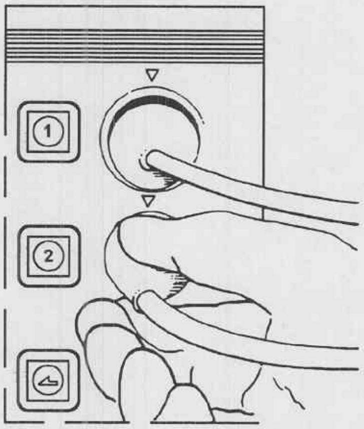
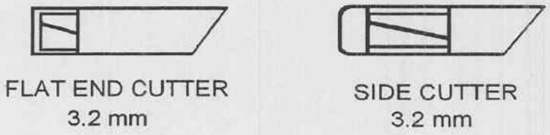


Figure 2-8. Handpiece connection.



FLAT END CUTTER
3.2 mm

SIDE CUTTER
3.2 mm

Figure 2-9. Cutters and bur.

2-8. Operating procedures.

a. Turn the APS on by depressing the **ON/OFF** switch (fig 2-10) on the left side of the APS console front panel.

b. Ensure that the battery has an adequate charge prior to setup by observing the battery charge level indicator (fig 2-11). Do not begin a surgical procedure if the battery charge level indicator light is in the yellow or red zone. The APS console may be connected into an electrical power wall receptacle during surgery to maintain or increase the charge level of the battery.

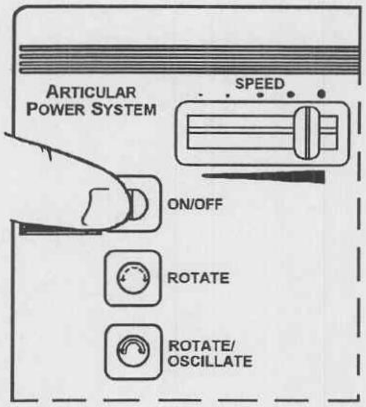

ARTICULAR
POWER SYSTEM
SPEED
ON/OFF
ROTATE
ROTATE/
OSCILLATE

Figure 2-10. Mode selection.

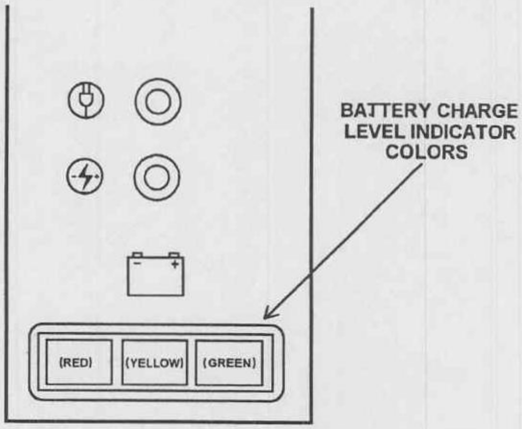

BATTERY CHARGE
LEVEL INDICATOR
COLORS
(RED)
(YELLOW)
(GREEN)

Figure 2-11. Battery charge level indicator colors.

c. Select the desired mode by depressing either the **ROTATE** mode selector switch or the **ROTATE/OSCILLATE** mode selector switch (fig 2-12). The switch that is depressed will be illuminated.

d. Select the desired handpiece and depress either the handpiece **1** selector switch or the handpiece **2** selector switch (2-13). Only one handpiece can be selected at a time. The selected switch will be illuminated when depressed.

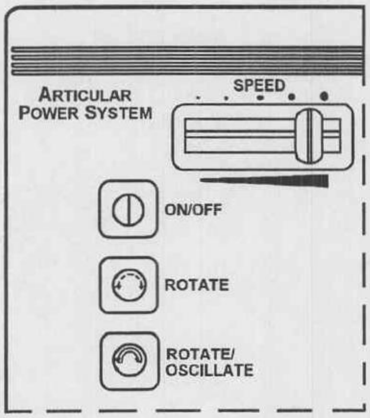

ARTICULAR
POWER SYSTEM
SPEED
ON/OFF
ROTATE
ROTATE/
OSCILLATE

Figure 2-12. Switches.

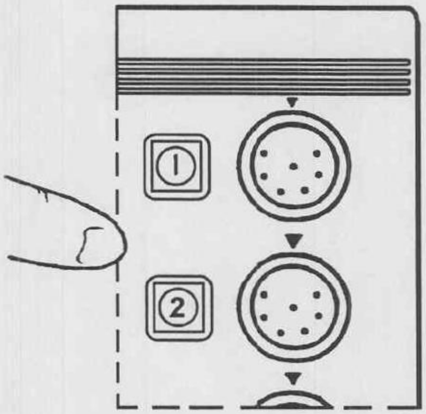


Figure 2-13. Handpiece selection.

e. Apply pressure to the finger operated control pad (fig 2-14) on either handpiece. Depress the control pad once and the handpiece will activate. Depress the control pad a second time and the handpiece will stop.

f. Observe that the handpiece speed is determined by the position of the APS console sliding **SPEED** control switch (fig 2-2). The handpiece speed can be adjusted by sliding the **SPEED** control to the left or to the right. The handpiece speed can be adjusted during operation.

g. The handpiece operating direction may be reversed by pressing the reverse button on the finger operated control pad (fig 2-15).

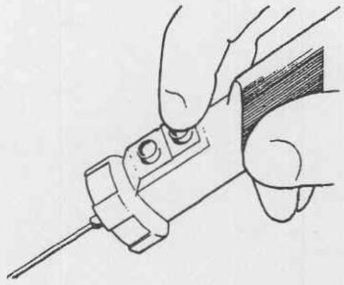


Figure 2-14. Handpiece activation.

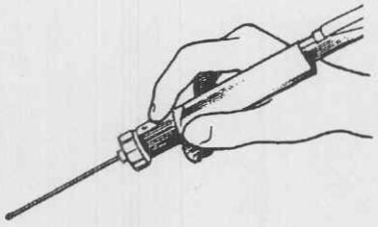


Figure 2-15. Direction selection.

h. The various functions of the handpieces and their controls are listed in table 2-1.

i. Set the aspiration control (fig 2-16) lever on the handpiece between the minimum (**MIN**) or maximum (**MAX**) for variable control.

j. Push the window positioning collar (fig 2-17) forward to unlock it from the handpiece and then turn the collar in either direction to the desired position.

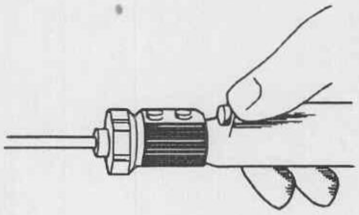


Figure 2-16. Aspiration control.

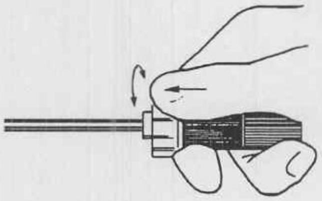


Figure 2-17. Cutter window position control.

k. Insert the footswitch connection plug into the corresponding receptacle on the APS console (fig 2-18). Then depress the blue footswitch selector switch beside the footswitch connector. When the footswitch selector illuminates, the footswitch is activated, and the fingertip controls will no longer regulate the handpieces.

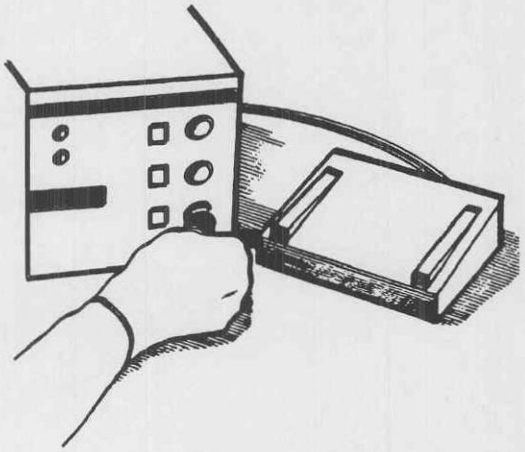


Figure 2-18. Foot control connection.

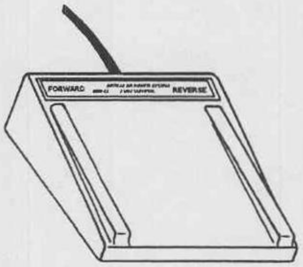


Figure 2-19. Footswitch.

l. To use the footswitch, depress either the forward or reverse footswitch bar (fig 2-19). To reactivate the handpiece fingertip controls, simply depress the blue footswitch selector on the console. The switch will no longer be illuminated.

2-9. Battery charging procedures.

a. Assemble the APS by following the assembly procedures in paragraph 2-3.

b. Observe that the red AC ON indicator and the red battery charging indicator are both illuminated (fig 2-20).

c. Observe that the **ON/OFF** is not illuminated (unless the APS is being used).

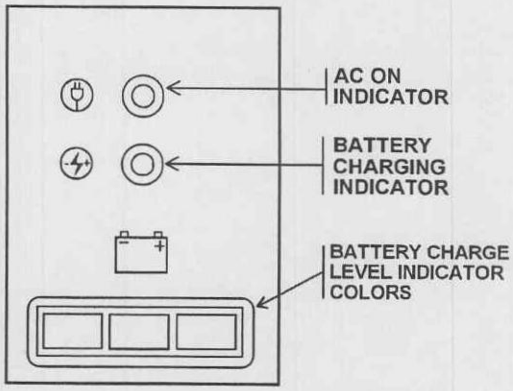

AC ON INDICATOR
BATTERY CHARGING INDICATOR
BATTERY CHARGE LEVEL INDICATOR COLORS

Figure 2-20. AC and battery indicators.

d. Observe the battery charging indicator and the battery charge level indicator periodically. The battery charger senses the charge level and when the battery charging indicator is off or slowly blinking, the battery is fully charged. The battery charge level indicator will also be in the green area.

e. Battery recharging is approximately three times the operating time. An approximate charge time may be derived from table 2-2.

Table 2-2. Charging time.

Battery Level Charge Indicator	*Minimum Charge Time*
Green	1 hour
Yellow	3 hours
Red	5 hours

2-10. Shut-down procedures.

a. Ensure that the window positioning collar (fig 2-21) on the handpiece is pushed rearward to lock it.

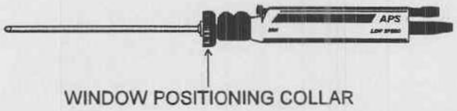


Figure 2-21. Window positioning collar.

b. Ensure that the **SPEED** control (refer to fig 2-2) is moved to the left position.

c. Depress either the **ROTATE** mode selector switch or the **ROTATE/OSCILLATE** mode selector switch, if illuminated. (Refer to fig 2-2.)

d. Depress either the handpiece **1** or the handpiece **2** selector switch, if illuminated. (Refer to fig 2-13.)

e. Depress the footswitch selector switch, if illuminated. (Refer to fig 2-2.)

f. Remove the handpiece.

g. Depress the **ON/OFF** switch to the **OFF** (not illuminated) position. (Refer to fig 2-2.)

h. Remove any cutter or bur by grasping it in one hand and grasping the APS handpiece in the other hand and pulling them apart. (Refer to figure 2-22.)

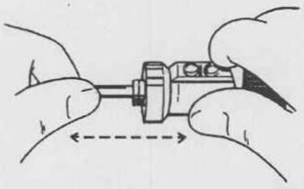


Figure 2-22. Cutter/bur removal.

Section IV. OPERATION OF AUXILIARY EQUIPMENT

2-11. Associated support items of equipment.

The APS requires no associated support items of equipment other than an electrical power generator, which is shared with multiple items of surgical equipment for electrical power.

2-12. Associated material.

Associated material is identified in appendix D and appendix E.

Section V. CLEANING, DISINFECTING, AND STERILIZING PROCEDURES

2-13. General.

a. The APS and operating accessories should be clean at all times. Specific cleaning, disinfecting, and/or sterilizing procedures are provided in subsequent paragraphs.

b. Follow your unit's standard operating procedures for the use of personal protective equipment when cleaning or disinfecting the components and accessories. Personal protective equipment may include goggles, mask, gloves, and gown or other suitable clothing.

2-14. Specific procedures.

a. Cleaning.

CAUTION

Do not immerse the APS console in a liquid and do not sterilize it.

(1) Ensure the electrical power cable assembly is disconnected from the electrical wall receptacle and the APS.

(2) Wipe the APS console with a cloth or sponge dampened with water, a mild detergent, or an alcohol/water solution. Do not use 100% alcohol or other solvents that may damage APS console front panel markings. Do not immerse it in a liquid.

(3) Dry the APS console with a clean soft cloth.

(4) Remove the cutter or bur (fig 2-23) from the handpiece before cleaning.

(5) Scrub the handpiece thoroughly with the drive cleaning brush and mild detergent. All traces of blood, coagulated material, disinfectant stains, etc., should be removed, particularly from the internal drive socket (fig 2-24) of the handpiece.

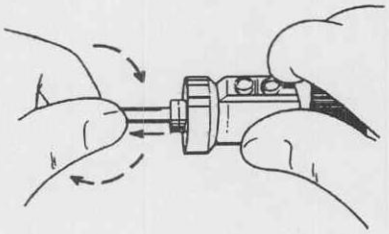


Figure 2-23. Cutter/bur removal for cleaning.

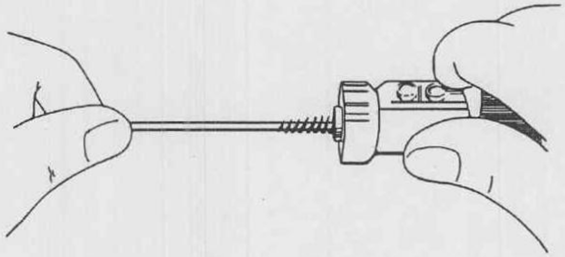


Figure 2-24. Cleaning internal drive socket.

(6) Rinse all traces of detergent from the handpiece by running water through the cutter/bur receptacle and aspirator tube connector (fig 2-25).

(7) Remove the aspiration control lever from the handpiece by firmly pulling it out from its receptacle and then flush it with water (fig 2-26).

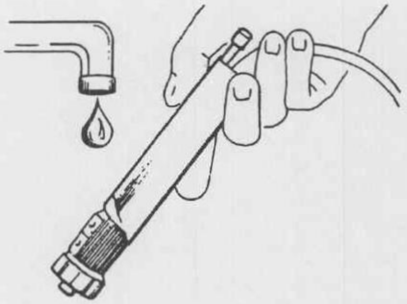


Figure 2-25. Rinsing.

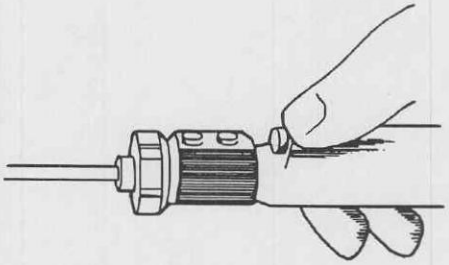


Figure 2-26. Aspiration control removal.

(8) Use the aspirator cleaning brush (fig 2-27) to remove any debris, flush it again with water and reinstall the aspiration control lever.

(9) Dry the handpiece with a lint-free cloth or towel. Do not lubricate handpieces at this point. Follow sterilization procedures.

b. Disinfecting.

(1) Immerse the APS handpieces for chemical disinfection, flush with water, and then dry the handpieces again.

(2) The APS console does not require disinfecting.

c. Sterilizing.

(1) Place the clean handpiece(s) and cutter(s)/bur(s) into the sterilization case (fig 2-28) either wrapped or unwrapped in accordance with unit procedures. If wrapping is required, two double thicknesses of number 140 thread count wrappers are recommended.

(2) Set the sterilizer for 132° - 133°C (270° - 272°F).

(3) Set the exposure time for 4 minutes (wrapped or unwrapped).

(4) Set the drying time for 5 minutes minimum.

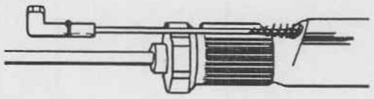


Figure 2-27. Aspirator control cleaning.

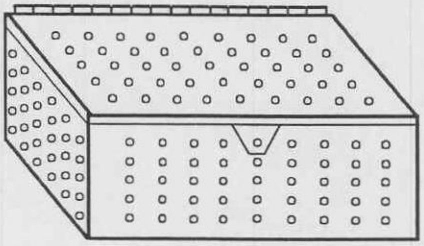


Figure 2-28. Sterilization case.

NOTE

If your sterilizer has a Pre-vacuum Cycle, use the "Hard Goods" cycle.

(5) Set the temperature and exposure periods as shown in table 2-3 if your have gravity air displacement sterilization.

Table 2-3. Gravity air displacement steam sterilization.

Temperature	*Exposure Time*
132° - 133°C (270° - 272°F)	12 minutes
121° - 123°C (250° - 254°F)	45 minutes
Drying time - minimum 5 minutes	

Section VI. OPERATION UNDER UNUSUAL CONDITIONS

2-15. General.

The APS unit is designed to operate only within a medical treatment facility.

2-16. Operating temperature/humidity ranges.

a. The APS should not be operated when the temperature is above 32°C (90°F) or below 15.6 °C (60°F).

b. The APS should not be operated when the humidity is outside the range of 10% to 95% (non-condensing).

CHAPTER 3

UNIT LEVEL MAINTENANCE

Section I. GENERAL INFORMATION

3-1. Overview.

a. Unit level maintenance. This level of maintenance is the responsibility of and performed by a using unit on its assigned equipment. Responsibilities are stratified as follows:

(1) *Operator maintenance*. This segment of unit level maintenance is performed by operator/user personnel and consists of equipment operational functions; routine services like cleaning, dusting, washing, checking for frayed cables, and stowing items not in use; and checking for loose hardware, replacing operator accessories, and replacing operator repair parts. Replacing operator parts will not require extensive disassembly or assembly of the end item, critical adjustments after replacement, or the extensive use of tools.

(2) *Specialist maintenance*. This segment of unit level maintenance is performed only by trained Medical Equipment Repairers. The functions and services include—

(a) Scheduling and performing PMCS, electrical safety inspections and tests, and calibration/verification/certification (CVC) services.

(b) Performing unscheduled maintenance functions with emphasis on replacing assemblies, modules, or printed circuit board (PCBs), when available.

(c) Operating a repair parts program to include Class VII repair parts as well as other commodity class repair parts used on medical equipment.

(d) Maintaining a library of technical manuals (TMs), manufacturer's literature, repair parts information, and related materials.

(e) Conducting inspections on new or transferred equipment.

(f) Establishing administrative procedures for the control and administration of maintenance services in accordance with TB 38-750-2.

(g) Notifying support maintenance battalions of requirements and/or evacuating unserviceable equipment, assemblies, or modules.

b. Maintenance functions. Maintenance functions, both preventive and corrective, which are beyond the scope of the operator/user are assigned to unit level Maintenance Equipment Repairer personnel. These personnel will perform the majority of maintenance required for the equipment except some tasks involving the APS module, handpieces, carrying case, and shipping case.

3-2. Tools and test equipment.

Common tools and test equipment required for unit level maintenance of the equipment are listed in appendix B, section III of this manual. Refer to your unit's modified table of organization and equipment (MTOE) for authorized items.

3-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, section II and III of this manual.

3-4. Expendable supplies.

Expendable and durable supplies and materials required for maintenance of the equipment are listed in appendix D, section II of this manual.

3-5. Repair parts.

Repair parts required for unit level maintenance are listed in appendix E, section II of this manual.

3-6. Special tools.

There are no special tools, test, or support equipment applicable for this end item.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

3-7. Unpacking the APS.

a. Remove the outer cardboard shipping container, if present.

b. Depress the pressure relief valve.

c. Open the 10 twist-lock latches and open the hinged lid of the shipping container.

d. Remove the carrying case. Set it aside.

e. Verify receipt of the following materiel starting with the shipping container and then the carrying case.

- (1) Shipping container.
  - (a) Sterilization case.
  - (b) Key, carrying case, 2 each.
  - (c) Side cutter, 3.2 mm, 3 each.
  - (d) Side cutter, 4.8 mm, 3 each.
  - (e) Flat end cutter, 3.2 mm, 3 each.
  - (f) Flat end cutter, 4.8 mm, 3 each.
  - (g) Transformer.
  - (h) Electrical power cable.
  - (i) Cannula, 25 mm, 2 boxes of 5.
  - (j) Cannula, 40 mm, 2 boxes of 5.
  - (k) Cannula, 75 mm, 2 boxes of 5.
  - (l) Operating Instructions, 2 each.
  - (m) Maintenance Instructions, 2 each.
  - (n) Electrical and Mechanical Assembly Detail Documents, 2 each.
- (2) Carrying case.
  - (a) Footswitch.
  - (b) Brush, cleaning, 2 each.
  - (c) Cannula, 25 mm, 2 each.
  - (d) Cannula, 40 mm, 2 each.
  - (e) Cannula, 75 mm, 2 each.
  - (f) Aspiration control lever (spare).
  - (g) Handpiece, high speed.
  - (h) Handpiece, low speed.

Section III. LUBRICATION INSTRUCTIONS

3-8. General.

No lubrication of the APS is required.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-9. General.

a. The APS must be inspected and serviced systematically to ensure that it is ready for operation at all times. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure.

b. Table 3-1 contains a list of items to be performed by unit level operator/user personnel. This PMCS table is also referred to as "-10 PMCS" requirements. There are things you should do any time they need to be done, such as checking for general cleanliness, observing for improper operational indicators, and maintaining the proper quantities of operating supplies.

c. Table 3-2 contains a list of items to be performed by unit level Medical Equipment Repairers. This PMCS table is also referred to as "-20 PMCS" requirements.

d. Some items to be inspected will be listed in both table 3-1 and table 3-2 to stress their importance, to provide a quality control check on multiple operator/user personnel, and to identify more comprehensive procedures to be accomplished by unit level Medical Equipment Repairers.

e. The following is a list of both PMCS table column headings with a description of the information found in each column:

(1) *Item No.* This column shows the sequence in which to do the PMCS, and is used to identify the equipment area on the Equipment Inspection and Maintenance Worksheet, DA Form 2404.

(2) *Interval.* This column shows when each PMCS item is to be serviced: B - Before Operation, D - During Operation, A - After Operation, Q - Quarterly, and S - Semiannually. B, D, and A should be performed with daily use of the equipment.

NOTE

When the arthroscopic unit must be kept in continuous operation, check and service only those items that will not disrupt operation. Perform the complete daily checks and services when the equipment can be shut down.

(3) *Item to be Inspected and Procedure.* This column identifies the general area or specific part to be checked or serviced.

(4) *Equipment is not Ready/Available If:*. This column lists conditions that make the equipment unavailable or unusable.

Table 3-1. Operator preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1						**APS.**	
	X		X		X	*a.* Ensure that all components and accessories are on hand.	Missing components or accessories prevent operation of the APS.
	X		X		X	*b.* Verify APS operation.	Operation indicates a malfunction or a hazardous situation.
2	X				X	**Battery.** Check that the battery can be fully charged.	The battery cannot be fully charged and the APS is needed for operation on battery power.
3	X				X	**Power cable assembly.** Check the electrical power cable assembly for cuts, fraying, or other physical damage.	The condition of the electrical power cable assembly prevents operation or causes a safety hazard.
4	X				X	**Footswitch.** Check the footswitch for proper operation.	A damaged or inoperable footswitch prevents use of the APS.
5						**Cases.**	
					X	*a.* Check the carrying case for locking, alignment, or physical defects.	A defective carrying case prevents proper storage of the APS.
					X	*b.* Check the shipping case for damage or deterioration caused by usage.	A defective shipping case prevents proper storage or shipment of the APS.

Table 3-2. Repairer preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1						**APS.**	
					X	*a.* Verify that components and accessories have been inventoried and/or requisitioned by operator/user personnel.	Missing components or accessories prevent operation of the APS.
					X	*b.* Verify the results of operator/user operational tests.	Operator/user tests indicate a hazardous condition or improper operation.
2					X	**Battery.** Verify that the battery is fully serviceable.	The battery cannot be fully charged or does not hold its charge and is required for operation on battery power.
3					X	**Power cable assembly.** Inspect the electrical power cable assembly for cuts, deterioration, fraying, or other physical damage.	The condition of the electrical power cable assembly prevents operation or causes a safety hazard.
4						**Cases.**	
					X	*a.* Inspect the carrying case for proper closing, locking, etc.	A defective carrying case prevents proper storage or local movement of the APS.
					X	*b.* Inspect the shipping case for damage or deterioration caused by usage.	A defective shipping case prevents proper storage or shipment of the APS.

3-10. Reporting deficiencies.

Operator/user personnel will report problems with the APS discovered during their "-10 PMCS" that they are unable to correct. Refer to TB 38-750-2 and report the deficiency using the proper forms. Consult with your unit Medical Equipment Repairer if you need assistance.

Section V. OPERATIONAL TESTING

3-11. General.

This section contains procedures for operational testing of the APS by both operator/user personnel and Medical Equipment Repairer personnel. Deficiencies identified by operator/user personnel should be reported to Medical Equipment Repairer personnel.

3-12. APS console test.

a. Ensure that the APS console has been acclimated to ambient room temperature prior to the operational checkout.

b. Perform the operational steps and observe the results by following table 3-3.

c. Refer to the troubleshooting tables (section VI) if the specified results are not obtained.

Table 3-3. APS console operational test.

Step	*Result*
1. Connect the APS console to a source of electrical power.	The red AC **ON** and battery charging indicators should illuminate.
2. Depress the **ON/OFF** switch.	The switch should lock in the depressed position; the **ON/OFF** switch, the **ROTATE** mode selector switch, and the handpiece **1** selector switches should illuminate when depressed.
3. Depress the **ROTATE/OSCILLATE** mode selector switch.	The **ROTATE** mode selector switch should not be illuminated and the **ROTATE/OSCILLATE** mode selector switch should be illuminated.
4. Depress the **ROTATE** mode selector switch.	The **ROTATE/OSCILLATE** mode selector switch should not be illuminated and the **ROTATE** mode selector switch should be illuminated.

3-13. APS handpiece operational test.

a. Do not use a cutter/bur to perform an operational test of the handpieces.

b. Perform the operational steps and observe the results by following table 3-4.

c. Refer to the troubleshooting tables(section VI) if the specified results are not obtained.

Table 3-4. APS handpiece(s) operational test.

Step	*Result*
1. Depress the **ON/OFF** switch. Depress the **ROTATE** mode selector switch. Depress the handpiece selector switch corresponding to the handpiece to be tested. Then depress the front (closest to the cutter receptacle) finger operating control pad once.	The handpiece should operate in a counterclockwise direction by observing the cutter receptacle.

Table 3-4. APS handpiece(s) operational test - continued.

Step	*Result*
2. Depress the front finger operating control pad again.	The handpiece should stop operating.
3. Depress the rear finger operating control pad once.	The handpiece should operate in a counterclockwise direction.
4. Depress the rear finger operating control pad again.	The handpiece should stop rotating.
5. Depress the handpiece **2** selector switch.	The handpiece **1** selector switch should not be illuminated. The handpiece **2** selector switch should be illuminated.
6. Depress the handpiece **1** selector switch.	The handpiece **2** selector switch should not be illuminated. The handpiece **1** selector switch should be illuminated.
7. Depress the footswitch selector switch so that it locks in the depressed position.	The footswitch selector switch should illuminate.
8. Depress the footswitch selector switch so that it unlocks from the depressed position.	The footswitch selector switch should not be illuminated.

3-14. Complete APS test.

a. Ensure that the two previous tests are completed and the results are as indicated.

b. Perform the operational steps and observe the results by following table 3-5.

c. Refer to the troubleshooting tables(section VI) if the specified results are not obtained.

Table 3-5. Complete APS operational test.

Step	*Result*
1. Depress the **ON/OFF** switch. Depress the **ROTATE/OSCILLATE** mode selector switch.	The **ON/OFF** switch and the **ROTATE/OSCILLATE** mode selector switch should illuminate.
2. Depress the front finger (closest to the cutter receptacle) operating control pad once.	The handpiece should operate in a clockwise direction.
3. Depress the front finger operating control pad again.	The handpiece should stop operating.
4. Depress the rear finger operating control pad once.	The handpiece should operate in an oscillatory fashion with approximately 1 second of clockwise motion followed by approximately 1 second of counterclockwise motion, then returning to a clockwise motion in a repeating fashion.
5. Depress the rear finger operating control pad again.	The handpiece should stop operating.
6. Depress the front finger operating control pad once.	The handpiece should operate in a clockwise direction.
7. Move the **SPEED** control on the front of the APS console to the left.	The speed of the handpiece should decrease.
8. Move the **SPEED** control on the front of the APS console to the right.	The speed of the handpiece should increase.

Table 3-5. Complete APS operational test - continued.

Step	*Result*
9. Depress the front finger operating control pad once.	The handpiece should stop operating.

3-15. Footswitch test.

a. Ensure that the three previous tests are completed and the results are as indicated.

b. Perform the operational steps and observe the results by following table 3-6.

c. Refer to the troubleshooting tables (section VI) if the specified results are not obtained.

Table 3-6. Footswitch operational test.

Step	*Result*
1. Depress the **ON/OFF** switch and depress the **ROTATE** mode selector switch.	The **ON/OFF** switch and the **ROTATE** mode selector switch should illuminate.
2. Plug the footswitch into the APS console. Then, depress the footswitch selector switch.	The footswitch selector switch should latch in the depressed position and illuminate.
3. Depress, in turn, the front and then the back finger operating control pad on the active handpiece.	The handpiece should not operate.
4. Depress and hold the left treadle of the footswitch.	The handpiece should operate in a clockwise direction.
5. Release the left treadle of the footswitch.	The handpiece should stop operating.
6. Depress and hold the right treadle of the footswitch.	The handpiece should operate in a counterclockwise direction.
7. Release the right treadle of the footswitch.	The handpiece should stop operating.

Section VI. TROUBLESHOOTING

3-16. General.

a. Troubleshooting information for the APS operator/user personnel and for Medical Equipment Repairer personnel is provided in this section. Corrective maintenance beyond the capability or authority of operator/user personnel will be indicated by the phrase "Notify your unit's Medical Equipment Repairer."

b. This manual cannot list all possible malfunctions. If a malfunction is either not listed or is not determined by routine diagnostic procedures, notify your appropriate maintenance support unit.

3-17. Operator/user troubleshooting.

Operator/user troubleshooting procedures are provided in table 3-7. Each symptom is followed by possible causes and corrective maintenance.

Table 3-7. Operator/user troubleshooting.

SYMPTOM
    POSSIBLE CAUSE
        CORRECTIVE MAINTENANCE

1. APS DOES NOT OPERATE; AC INDICATOR ILLUMINATES.

Defective **ON/OFF** switch.

Notify your unit's Medical Equipment Repairer.

Defective **ROTATE** or **ROTATE/OSCILLATE** switch.

Notify your unit's Medical Equipment Repairer.

Defective handpiece connector(s).

Notify your unit's Medical Equipment Repairer.

Defective handpiece selector switch(es).

Notify your unit's Medical Equipment Repairer.

2. APS DOES NOT OPERATE; AC INDICATOR DOES NOT ILLUMINATE.

Defective electrical power cable assembly.

Notify your unit's Medical Equipment Repairer.

Defective fuse.

Notify your unit's Medical Equipment Repairer.

3. BATTERY NOT CHARGED; INDICATOR NOT IN GREEN AREA.

Defective battery charge level indicator.

Notify your unit's Medical Equipment Repairer.

Defective battery charging circuitry.

Notify your unit's Medical Equipment Repairer.

Defective battery.

Notify your unit's Medical Equipment Repairer.

4. HANDPIECE(S) INOPERATIVE.

Handpiece defective.

Replace the handpiece.

Handpiece connector defective.

Notify your unit's Medical Equipment Repairer.

Handpiece selector switch not depressed (not illuminated).

Depress the desired handpiece selector switch. If still not operational, notify your unit's Medical Equipment Repairer.

5. FOOTSWITCH INOPERATIVE.

Footswitch selector switch not depressed (not illuminated).

Depress selector switch. If still not operational, notify your unit's Medical Equipment Repairer.

Defective footswitch.

Notify your unit's Medical Equipment Repairer.

3-18. Medical Equipment Repairer troubleshooting.

a. Medical Equipment Repairer troubleshooting procedures are provided in table 3-8. Each symptom is followed by possible causes and corrective maintenance.

b. A wiring diagram for troubleshooting is provided in figure 3-1.

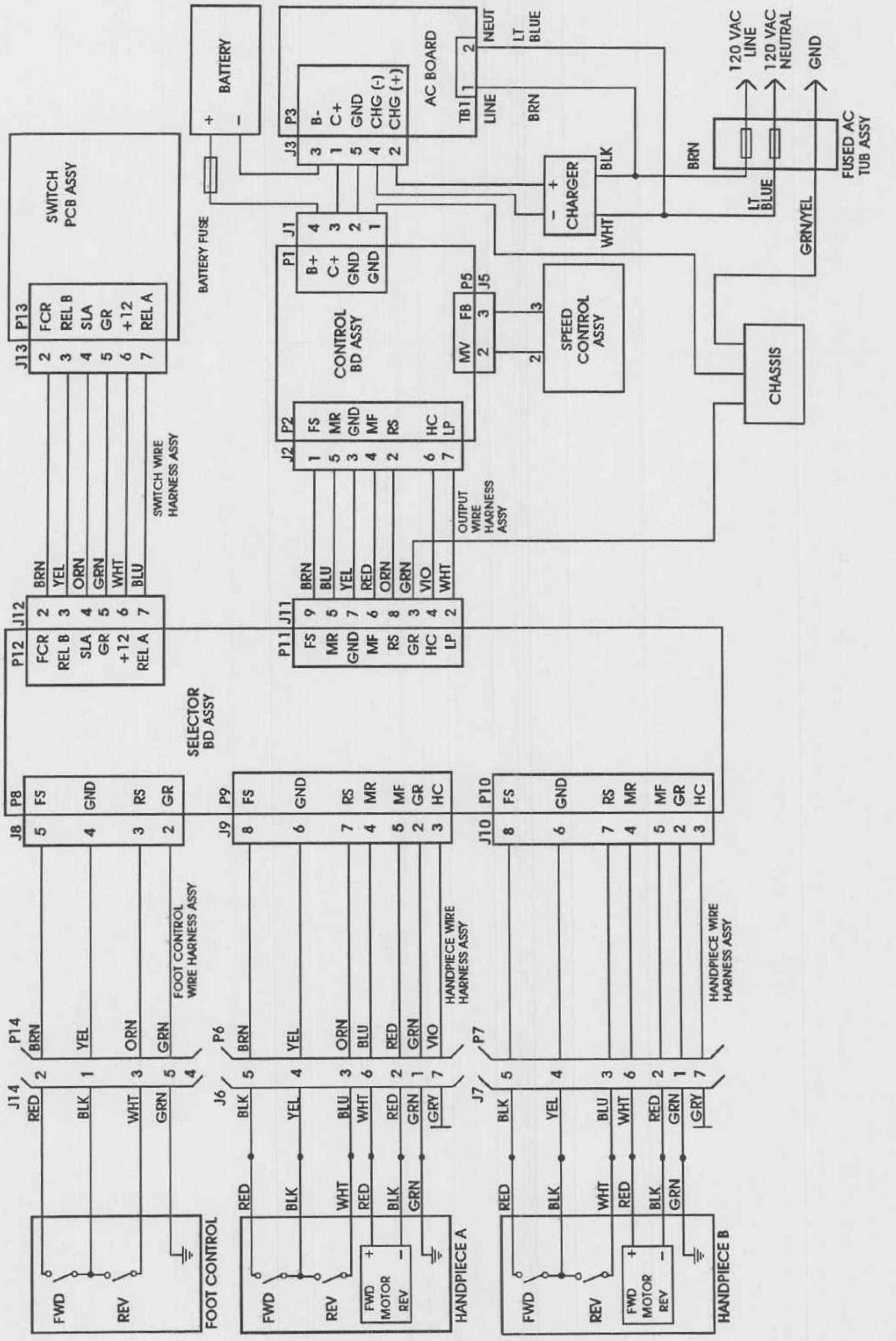

SWITCH PCB ASSY
P13
J13
FCR
REL B
SLA
GR
+12
REL A
BATTERY
BATTERY FUSE
AC BOARD
P3
J3
B-
C+
GND
CHG (-)
CHG (+)
TB1
NEUT
LINE
LT BLUE
BRN
120 VAC LINE
120 VAC NEUTRAL
GND
CHARGER
BLK
WHT
FUSED AC TUB ASSY
GRN/YEL
P1
J1
B+
CONTROL BD ASSY
P5
J5
MV
FB
SPEED CONTROL ASSY
CHASSIS
P2
J2
FS
MR
MF
RS
HC
LP
SWITCH WIRE HARNESS ASSY
OUTPUT WIRE HARNESS ASSY
P12
J12
P11
J11
SELECTOR BD ASSY
P8
J8
P9
J9
P10
J10
FOOT CONTROL WIRE HARNESS ASSY
HANDPIECE WIRE HARNESS ASSY
P14
J14
P6
J6
P7
J7
RED
YEL
ORN
GRN
BLU
VIO
GRY
FWD
REV
FWD MOTOR REV
FOOT CONTROL
HANDPIECE A
HANDPIECE B

Figure 3-1. Wiring diagram.

Table 3-8. Medical Equipment Repairer troubleshooting.

SYMPTOM

POSSIBLE CAUSE

CORRECTIVE MAINTENANCE

---

1. APS DOES NOT OPERATE.

Defective electrical power cable assembly.

Repair or replace the cable.

Defective 115-volt electrical receptacle.

Notify your unit's electrical power system personnel or correct the problem within the International Standards Organization (ISO) shelter.

Defective **ON/OFF** switch.

Repair or replace the switch.

Defective **SPEED** control switch.

Repair or replace the switch.

2. APS INOPERABLE ON BATTERY POWER.

Battery discharged.

Recharge battery.

Defective battery charge level indicator causes no emphasis upon recharging.

Troubleshoot the APS and repair the charging circuitry.

Battery defective.

Test the battery and replace it.

3. APS DOES NOT OPERATE; AC INDICATOR ILLUMINATES.

Defective **ON/OFF** switch.

Troubleshoot the power input circuitry and repair defect(s) or replace the switch.

Defective **ROTATE** or **ROTATE/OSCILLATE** switch.

Troubleshoot the control circuitry and repair defect(s) or replace the defective switch(es).

Defective handpiece connector(s).

Troubleshoot the circuitry and repair defect(s) or replace the defective connector(s).

Defective handpiece selector switch(es).

Troubleshoot the circuitry and repair defect(s) or replace the defective switch(es).

4. HANDPIECE(S) INOPERATIVE.

Handpiece connector defective.

Replace connector.

Handpiece selector switch not illuminated.

Switch not depressed or switch defective. Replace switch(es).

Handpiece defective.

Repair or replace handpiece(s).

Table 3-8. Medical Equipment Repairer troubleshooting - continued.

SYMPTOM

POSSIBLE CAUSE

CORRECTIVE MAINTENANCE

5. FOOTSWITCH INOPERATIVE.

Defective connector.

Repair or replace connector.

Defective footswitch selector switch.

Replace switch.

Defective footswitch.

Repair or replace footswitch.

Section VII. FUNCTIONAL DESCRIPTIONS

3-19. General (fig 3-2).

The following graphic illustrates the various circuits of the APS.

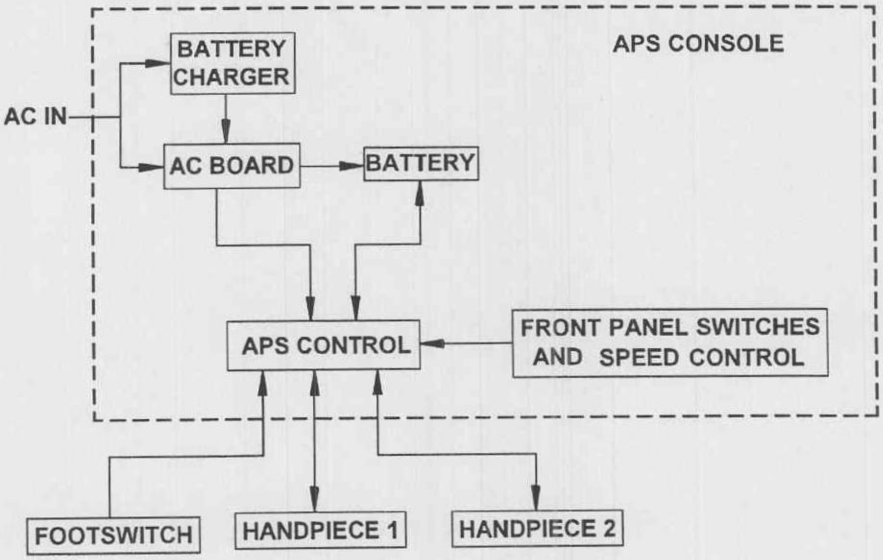

APS CONSOLE
BATTERY CHARGER
AC IN
AC BOARD
BATTERY
APS CONTROL
FRONT PANEL SWITCHES AND SPEED CONTROL
FOOTSWITCH
HANDPIECE 1
HANDPIECE 2

Figure 3-2. Block diagram.

3-20. Input power (AC in).

Input power is provided to the APS via a standard 115-volt receptacle and provides electrical protection. The AC electrical power is distributed to the battery charger and the AC board.

3-21. Battery charger.

The battery charger is a standard commercial module designed to charge a 12-volt lead-acid storage battery. The battery charger output is connected to the AC board. The charger has LEDs to display charger power on and charger fast charge mode. The LEDs are visible in the front panel.

3-22. AC board.

The AC board is used to disconnect the battery charger from the battery when the charger is not energized and also distributes power from the battery to the APS control PCB.

3-23. Battery.

The battery is a standard 12-volt gel-cell lead-acid battery. The battery positive (+) voltage is distributed to the APS control through a fused receptacle located inside the APS console and is accessible when the cover is removed. The battery negative (-) is connected to the AC board.

3-24. APS control.

The APS control consists of three PCBs (control board assembly, switch PCB assembly, and the selector board assembly). Electrical power and control are through these PCBs.

a. Control board assembly. This PCB controls handpiece motor power, direction, mode, and speed. The PCB monitors and displays battery charge and is the connection point for the **ON/OFF, ROTATE,** and **ROTATE/OSCILLATE** front panel switches. The handpiece **SPEED** control is connected through this PCB.

b. SPEED control assembly. This assembly consists of a linear slide resistor and interconnecting cable which connects to the APS control.

c. Switch PCB assembly. The switch control assembly provides electrical connections and mounting for handpiece **1**, handpiece **2**, and foot control mode switches controlled from the front panel.

d. Selector board assembly. The selector board assembly provides electrical connections and mounting for the three relays required to select handpiece **1**, handpiece **2**, or the foot control option.

e. Handpiece 1 and 2. The handpiece **1** can be either a high or low speed unit. Either handpiece consists of a small brush type motor and two momentary contact switches to control operation ofthe unit. The handpieces have a permanently attached cord and connector.

f. Footswitch. The footswitch consists of two momentary contact switches and connects to the APS console through a permanently attached cord and connector.

Section VIII. CIRCUIT DESCRIPTIONS

3-25. Power supply selection PCB (fig 3-3).

The power supply selection PCB is attached to the lower right inside of the APS console. The power supply selection PCB schematic shows the relays in the non-activated (relay not switched) position. This is the position the relays are in when the unit is turned on. The relays connect the number **1** handpiece to the control electronics to make it the active handpiece. When the number **2** handpiece control switch on the front of the unit is depressed, relays K1 and K3 switch and latch to disconnect handpiece number **1** and connect handpiece number **2**. Relay K2 switches and latches when the front panel footswitch control is depressed. This disconnects the forward and reverse switches from the handpieces and substitutes the footswitch controls. A second depression of the footswitch control places the relay back in its original non-activated state and returns the control of the handpieces to their switches.

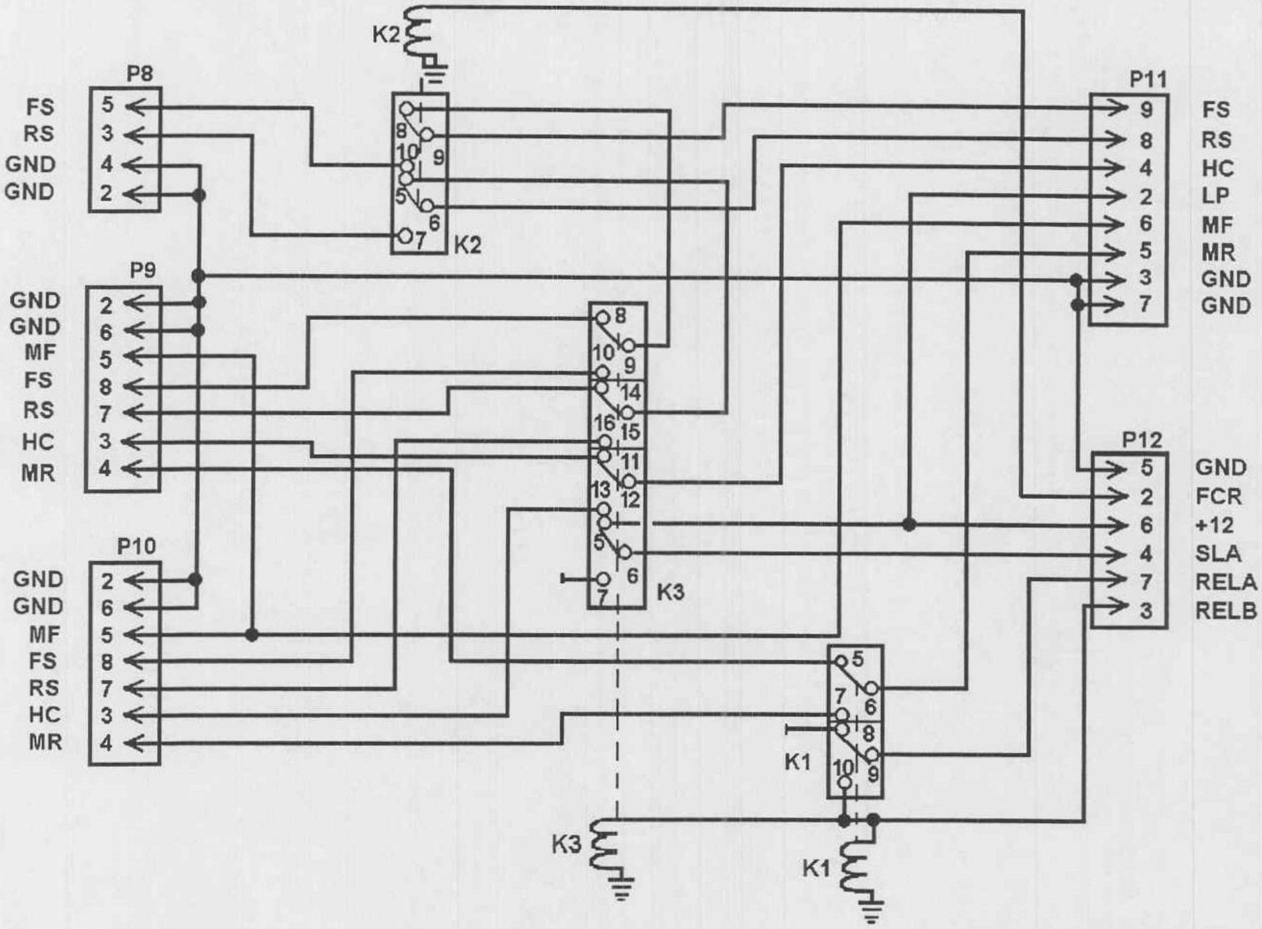

K2
P8
FS 5
RS 3
GND 4
GND 2
P9
GND 2
GND 6
MF 5
FS 8
RS 7
HC 3
MR 4
P10
GND 2
GND 6
MF 5
FS 8
RS 7
HC 3
MR 4
K2
K3
K1
K3
K1
P11
9 FS
8 RS
4 HC
2 LP
6 MF
5 MR
3 GND
7 GND
P12
5 GND
2 FCR
6 +12
4 SLA
7 RELA
3 RELB

Figure 3-3. Power supply selection PCB.

3-26. AC power supply PCB (fig 3-4).

The bridge rectifier PSI, resistor R1, and capacitor C1 rectifies and filters the generated electrical power to provide the coil voltage for relay K1 when AC power is present. Relay K1 controls whether the unit power is derived from the battery charger (AC power present) or just the battery (AC power absent).

3-27. Power supply switch PCB (fig 3-5).

This PCB holds handpiece **1** and handpiece **2** controls and the footswitch control onto the right front of the front panel. The switches are shown in their resting state (not depressed). The light indicators for each switch are shown at the bottom of each symbol. The operation of these switches controls the relays on the AC power supply PCB as previously described.

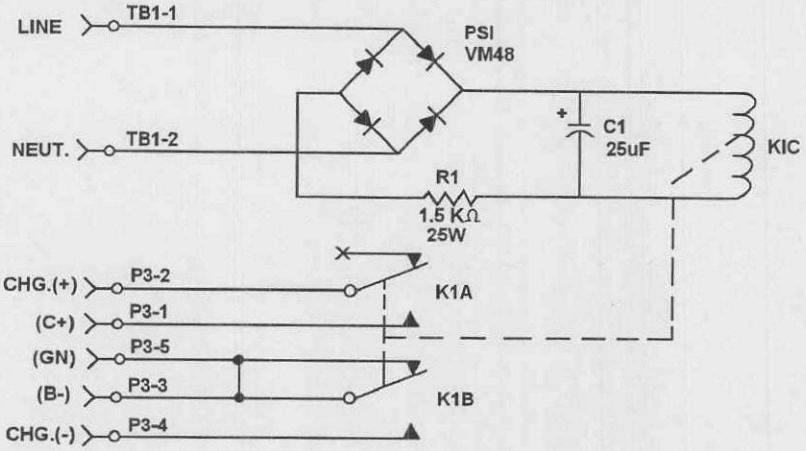

LINE
TB1-1
PSI
VM48
NEUT.
TB1-2
C1
25uF
KIC
R1
1.5 KΩ
25W
CHG.(+)
P3-2
K1A
(C+)
P3-1
(GN)
P3-5
(B-)
P3-3
K1B
CHG.(-)
P3-4

Figure 3-4. AC power supply PCB.

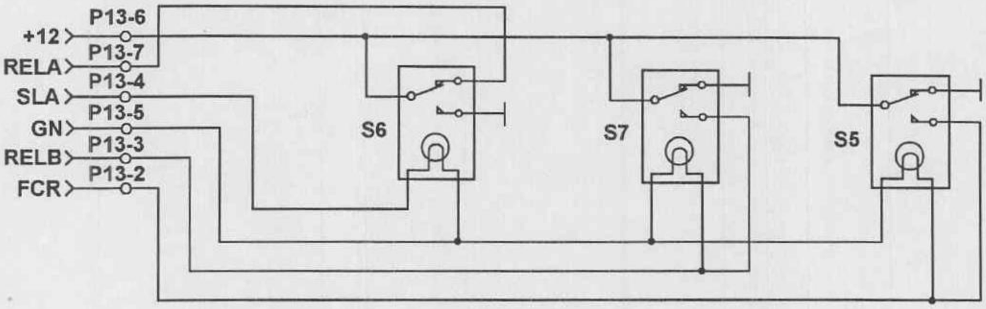

+12
P13-6
RELA
P13-7
SLA
P13-4
GN
P13-5
RELB
P13-3
FCR
P13-2
S6
S7
S5

Figure 3-5. Power supply switch PCB.

3-28. Footswitch schematic (fig 3-6).

This schematic shows the footswitch with no pedals depressed.

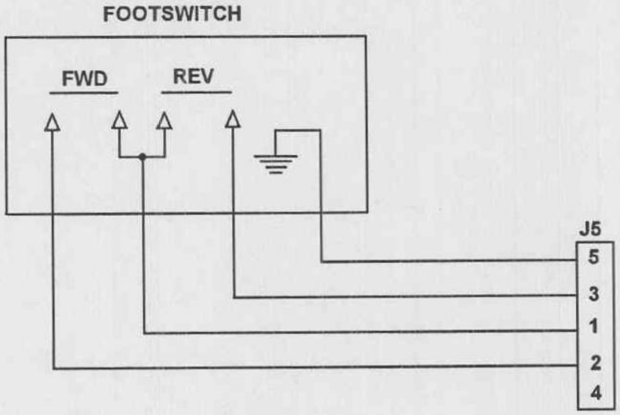

FOOTSWITCH
FWD
REV
J5
5
3
1
2
4

Figure 3-6. Footswitch and cord schematic.

3-29. APS wiring diagram.

This general wiring diagram shows the connectors and cabling that joins the various PCBs and sub-assemblies. (Refer to figure 3-1.)

3-30. Control PCB (sheet 1) (fig 3-7).

This section of the control PCB schematic shows the drive electronics which provide the power to the handpieces. Transistors Q5, Q6, Q8, and Q9 are used as switches to control the connection and disconnection to the electrical power and return lines for the handpiece motors. When the forward signal is high, Q5 is on, connecting P2-4 (motor forward - MTR FWD) to the return path. Transistor Q9 is on, connecting P2-5 (motor reverse - MTR REV) to the power source (**SPEED**). Transistors Q6 and Q8 are off. Fuse (F1) and components CR20, C31, and C32 provide damping and protection of the power source. The front panel slide switch, which controls the speed of the handpiece, is used as a variable resistance providing feedback to a pulse width modulating chip.

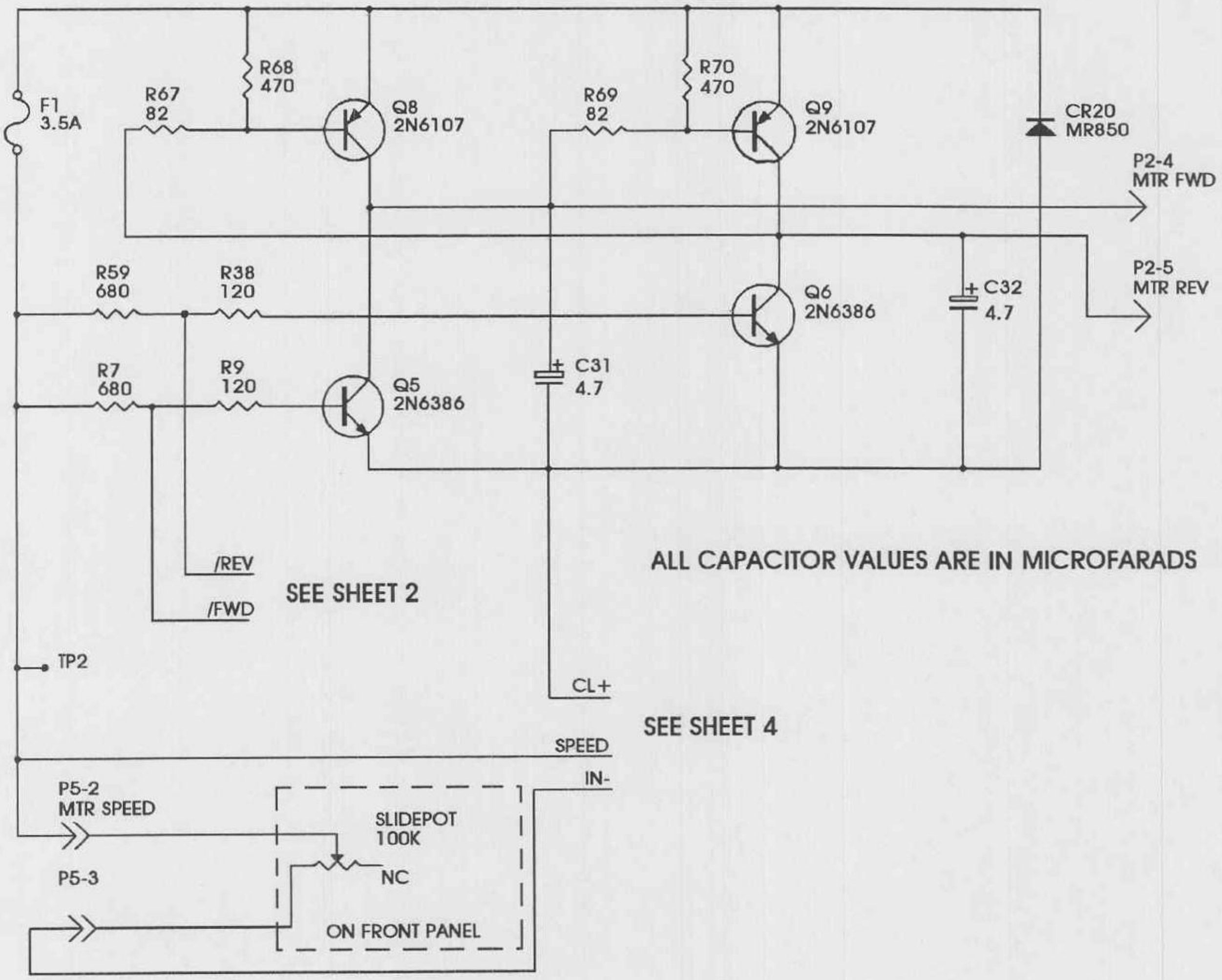

F1
3.5A
R67
82
R68
470
Q8
2N6107
R69
82
R70
470
Q9
2N6107
CR20
MR850
P2-4
MTR FWD
P2-5
MTR REV
R59
680
R38
120
Q6
2N6386
C32
4.7
R7
680
R9
120
Q5
2N6386
C31
4.7
/REV
/FWD
SEE SHEET 2
ALL CAPACITOR VALUES ARE IN MICROFARADS
TP2
CL+
SEE SHEET 4
SPEED
IN-
P5-2
MTR SPEED
SLIDEPOT
100K
NC
P5-3
ON FRONT PANEL

Figure 3-7. Control PCB (sheet 1).

3-31. Control PCB (sheet 2) (fig 3-8).

This section of the control PCB schematic shows the digital logic associated with the control switches and with the logic signals controlling handpiece rotation direction. The resistors R3 and R6 are pull ups for the reverse switch (/RS) and forward switch (/FS) lines. The slash (/) indicates that the lines are low-active. Circuit U3:C, U4 and the associated passive components creates a single 25 nSec pulse at pin 13 of U4 whenever a forward or reverse switch is depressed on the footswitch or a handpiece. This pulse acts as a clock to the JK flip flops in U2. The /RS and /FS signals are also fed into U1, which in conjunction with U2, acts as a single depression debounce and latch for the forward or reverse switch depression. Resistors R2 and R5, rectifiers CR1 and CR3, and capacitor C2 provide power up and power down control of the clear lines in U2. The lines are low active. If signal line power - the output of the battery charger (LP) is present, then when the unit's power switch is turned on the clear lines immediately go high allowing U2 to correctly capture any command signals. When the unit is turned off, C2 allows the clear line to decay more slowly than the +5V line so that the outputs of U2 do not change state. Components U3 and U14 accept the latched signals from U2 (representing switch activation) as well as the signals controlling oscillation (OSM, /OSM, Phase_A, and Phase_B) and decodes these into the correct feeds for U7. Component U7 provides the logic signals that control the polarity of the voltage being fed to the handpiece. When a handpiece is operating in the forward direction, the signal /FWD (U7, pin 3) is low and the signal /REV (U7, pin 5) is high. When the handpiece is operating in the reverse direction the signals are reversed. In the oscillate mode the signals alternate every 1.11 seconds.

3-32. Control PCB (sheet 3) (fig 3-9).

This portion of the control PCB illustrates the circuitry that displays the status of the power supply. Component U10 and its associated resistors and capacitors provide the voltage needed to drive the bar displays. The power supply voltage is taken from signal LP. This signal is processed by dual LED display drivers U11 and U12. Resistors R52 and R53 provide a precision voltage divider to lower the voltage before being fed into U11 and U12. Capacitor C60 buffers the power supply voltage to prevent noise from rapidly changing the display. Resistors R55 and R58 control the brightness of the LEDs. Diodes CR15 through CR18 are used as dummy loads to take the place of unused LED positions.

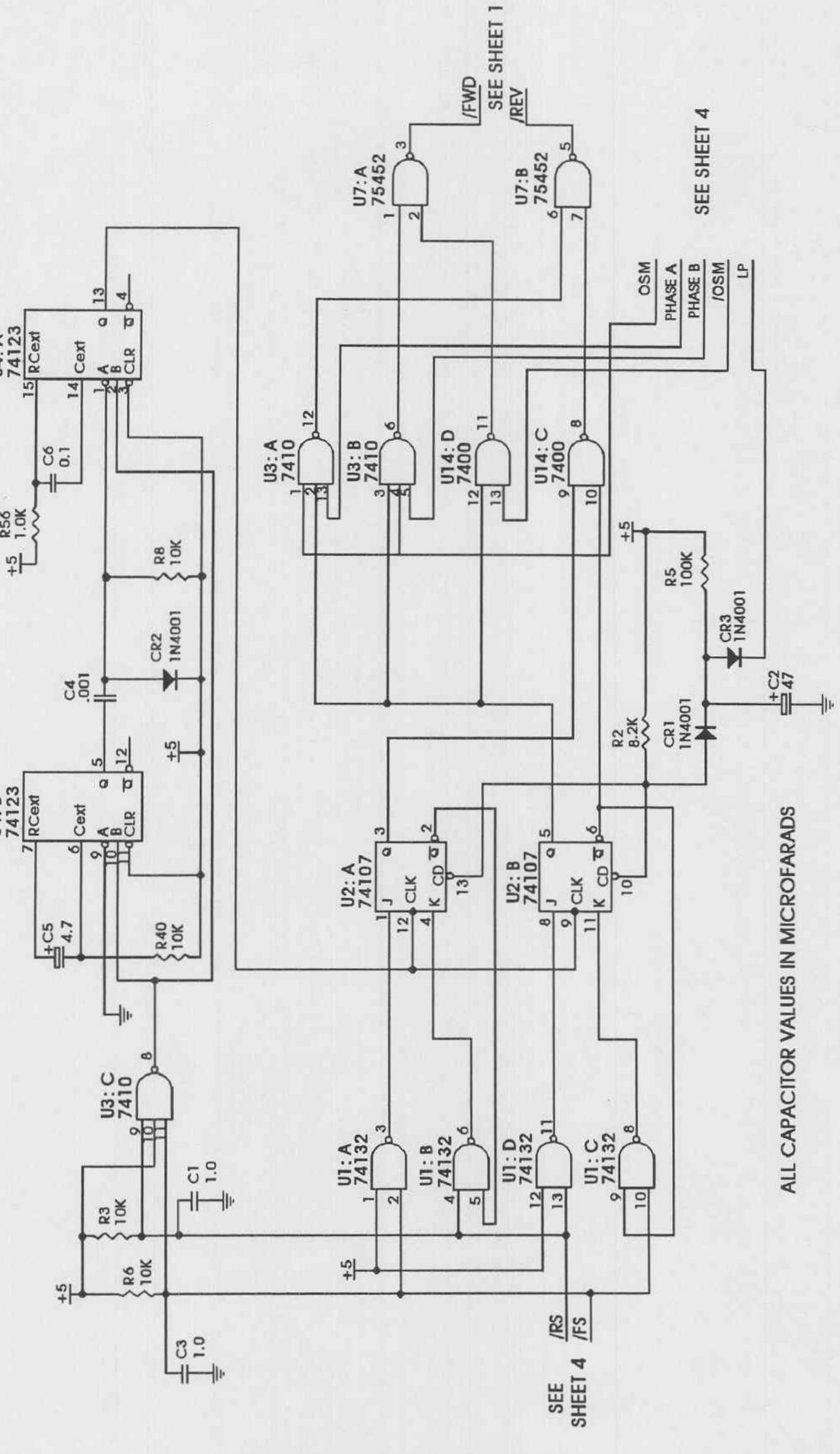
3-33. Control PCB (sheet 4) (fig 3-10).

This section of the control PCB schematic shows the logic that decodes the **ROTATE/OSCILLATE** modes and provides the signals that control them. It also shows the circuit that controls the handpiece voltage that determines rotational speed. The front panel **ROTATE** (S3) and **OSCILLATE** (S4) switches feed U14 to toggle between the two operating modes. Resistors R60, R61, R62, and R63; capacitors C55 and C56 act to pull up and filter the switch lines. When in the **ROTATE** mode, U14, pin 3 (/OSM) is high and U14, pin 6 (OSM) is low. These signal levels are reversed for the **OSCILLATE** mode. These signals also feed U15 and U17. Component U15 is used as a lamp driver to illuminate the switch that is active. When U17 is active (in **OSCILLATE** mode) waveform A is present on signals Phase_A and Phase_B. These signals have opposite phases (when A is high, B is low).

NOTE

Waveform A is provided with the test voltages.

Component U16 and its associated components act as a pulse width modulating circuit whose output is filtered by resistors R15 and R17, and capacitor C17 to drive transistor Q1. The output of Q1 is the signal (**SPEED**) which is a variable voltage that is used as the power source for the switching transistors Q5, Q6, Q8, and Q9.


U4: A
74123
RCext
Cext
A
B
CLR
Q
Q̄
U4: B
74123
R56
1.0K
C6
0.1
C4
.001
CR2
1N4001
R8
10K
+C5
4.7
R40
10K
U3: C
7410
R3
10K
R6
10K
C1
1.0
C3
1.0
+5
U1: A
74132
U1: B
74132
U1: D
74132
U1: C
74132
/RS
/FS
SEE
SHEET 4
U2: A
74107
U2: B
74107
J
K
CLK
CD
U3: A
7410
U3: B
7410
U14: D
7400
U14: C
7400
U7:A
75452
U7:B
75452
/FWD
SEE SHEET 1
/REV
SEE SHEET 4
OSM
PHASE A
PHASE B
/OSM
LP
R5
100K
CR3
1N4001
R2
8.2K
CR1
1N4001
+C2
47

ALL CAPACITOR VALUES IN MICROFARADS

Figure 3-8. Control PCB (sheet 2).

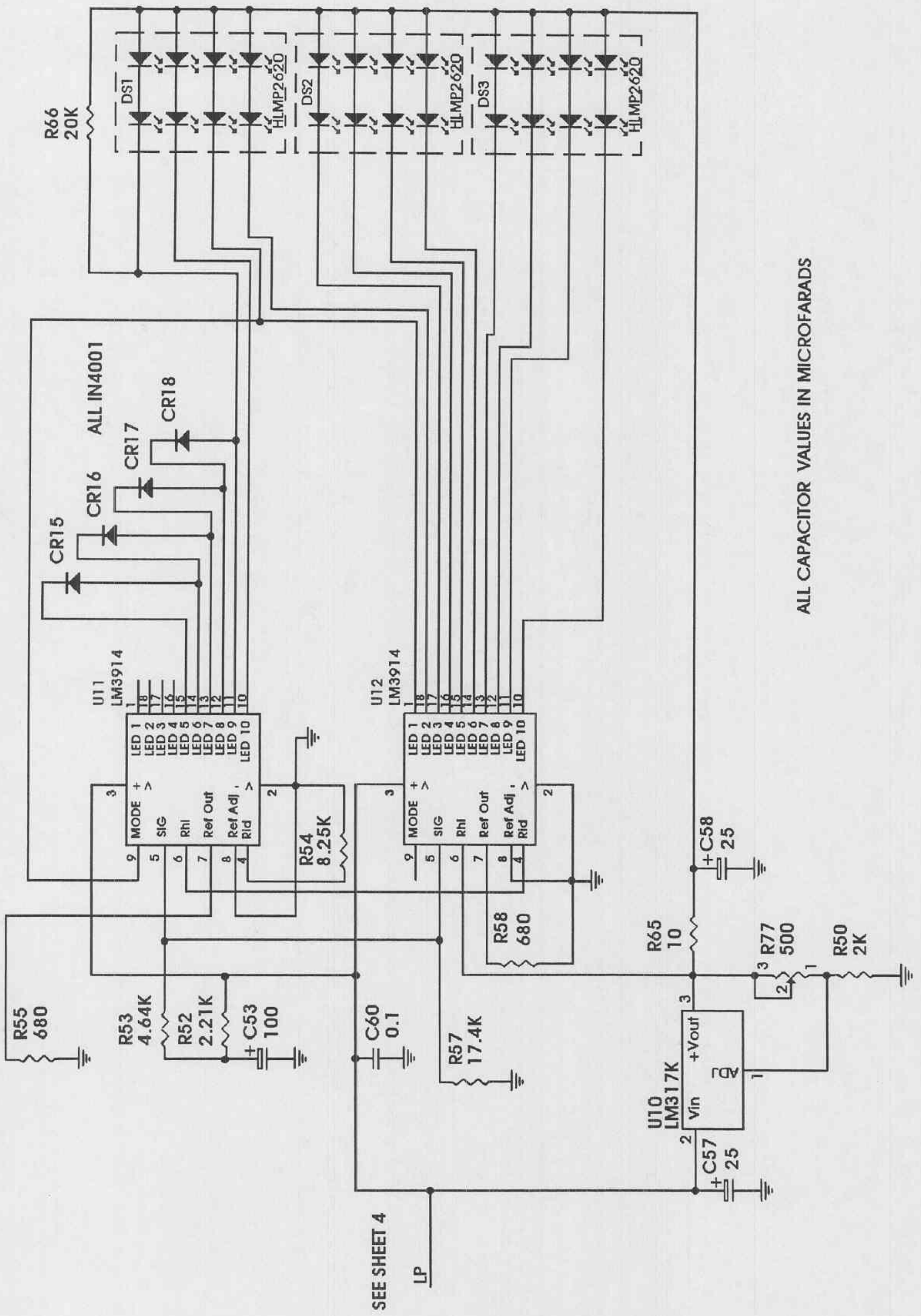

R66
20K
DS1
HLMP2620
DS2
HLMP2620
DS3
HLMP2620
ALL IN4001
CR15
CR16
CR17
CR18
U11
LM3914
U12
LM3914
MODE
SIG
RHI
Ref Out
Ref Adj
RLO
LED 1
LED 2
LED 3
LED 4
LED 5
LED 6
LED 7
LED 8
LED 9
LED 10
R54
8.25K
R58
680
R55
680
R53
4.64K
R52
2.21K
C53
100
C60
0.1
R57
17.4K
C58
25
R65
10
R77
500
R50
2K
U10
LM317K
Vin
+Vout
ADJ
C57
25
SEE SHEET 4
LP
ALL CAPACITOR VALUES IN MICROFARADS

Figure 3-9. Control PCB (sheet 3).

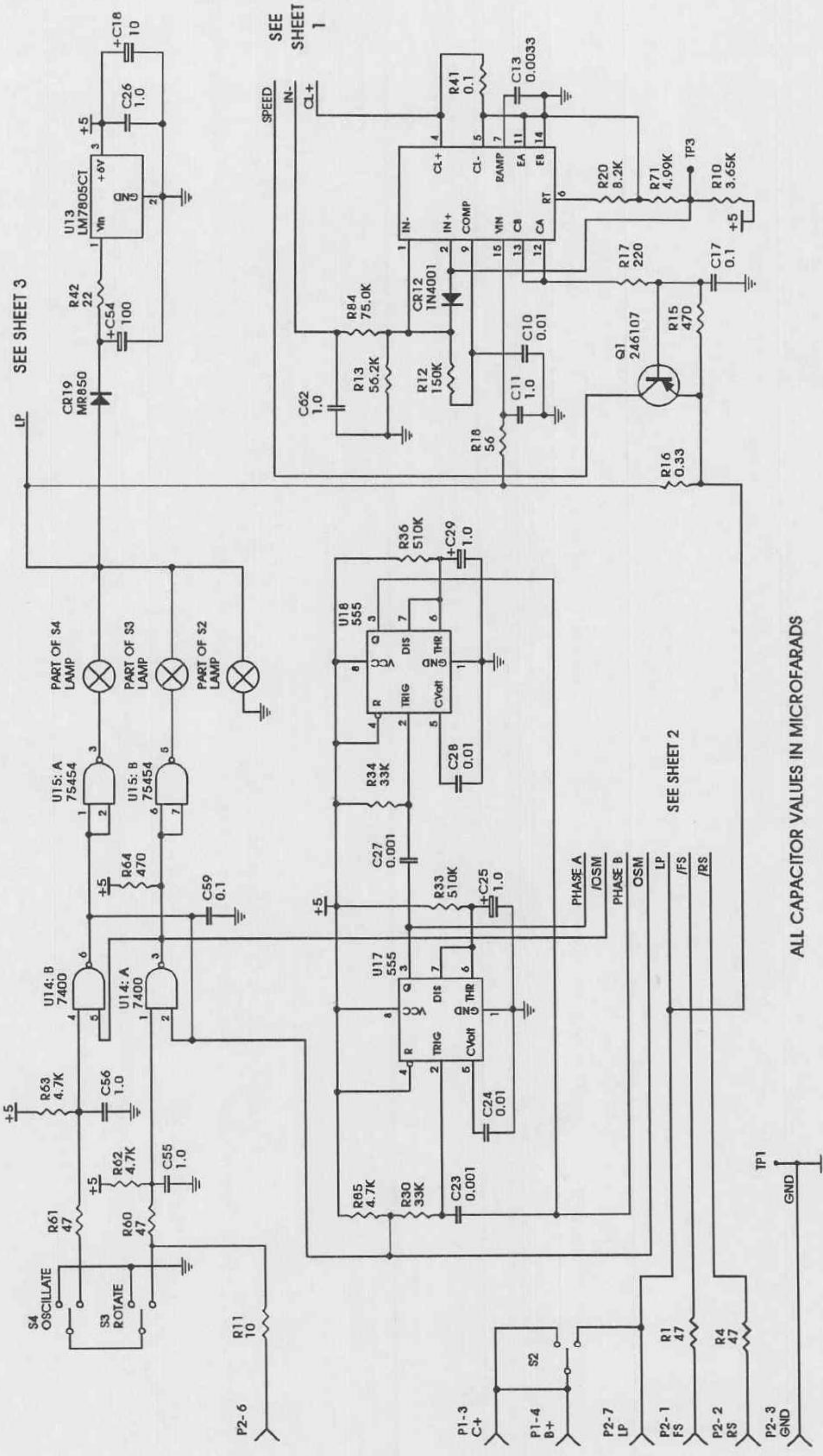

SEE SHEET 3
LP
CR19
MR850
R42
22
+C54
100
U13
LM7805CT
Vin
GND
+6V
+5
C26
1.0
+C18
10
SEE SHEET 1
SPEED
IN-
CL+
R41
0.1
C13
0.0033
CL+
CL-
RAMP
EA
EB
IN-
IN+
COMP
VIN
CB
CA
RT
R20
8.2K
R71
4.99K
TP3
R10
3.65K
+5
R84
75.0K
CR12
1N4001
R17
220
C17
0.1
C62
1.0
R13
56.2K
R12
150K
C10
0.01
C11
1.0
Q1
246107
R15
470
R18
56
R16
0.33
PART OF S4 LAMP
PART OF S3 LAMP
PART OF S2 LAMP
U15: A
75454
U15: B
75454
R36
510K
+C29
1.0
U18
555
R
TRIG
CVolt
VCC
Q
DIS
THR
GND
C28
0.01
R34
33K
C27
0.001
R33
510K
+C25
1.0
U17
555
C24
0.01
PHASE A
/OSM
PHASE B
OSM
LP
/FS
/RS
SEE SHEET 2
+5
R64
470
C59
0.1
U14: B
7400
U14: A
7400
R63
4.7K
C56
1.0
R62
4.7K
C55
1.0
R61
47
R60
47
S4
OSCILLATE
S3
ROTATE
R11
10
P2-6
R65
4.7K
R30
33K
C23
0.001
TP1
GND
S2
P1-3
C+
P1-4
B+
P2-7
LP
P2-1
FS
P2-2
RS
P2-3
GND
R1
47
R4
47
ALL CAPACITOR VALUES IN MICROFARADS

Figure 3-10. Control PCB (sheet 4).

Section IX. TEST VOLTAGES AND WAVEFORMS

3-34. Test voltages and waveforms.

a. Test voltages and waveforms for specific operating modes are provided in figure 3-11 and table 3-9.

b. The following notes apply to the table below.

(1) TP1 is ground

(2) All voltages are VDC unless otherwise specified.

(3) See figures 3-4 thru 3-10 for corresponding schematics.

(4) All voltages are typical and tolerance is +/- 0.1 volts.

(5) When handpiece is operating in the forward direction only.

(6) When handpiece is operating in the reverse direction only.

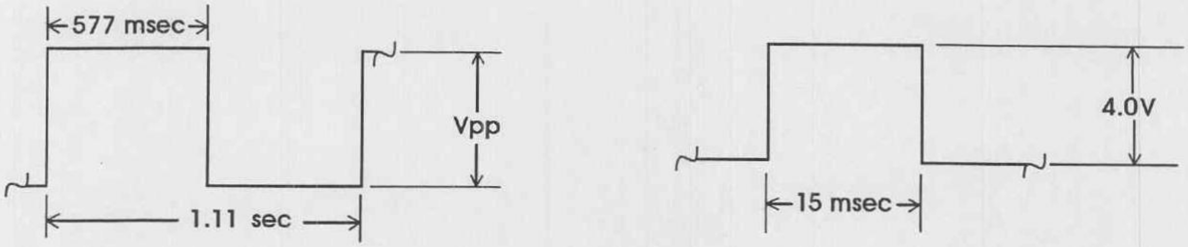
(7) When handpiece is operating in any mode except forward.

(8) When handpiece is operating in any mode except reverse.

c. A component diagram is provided in figure 3-12 to assist in locating the test points.

Table 3-9. Operating modes.

Test Point Location	*Idle*	*Minimum Speed*	*Maximum Speed*	*Oscillate Minimum Speed*	*Oscillate Maximum Speed*
U2 pin 3	0.1V	0.1V[5]	0.1V[5]	0.1V	0.1V
U2 pin 5	0.1V	3.7V[6]	3.7V[6]	3.7V	3.7V
U3 pin 12	3.8V	3.8V	3.8V	Waveform A Vpp = 3.8	Waveform A Vpp = 3.8
U14 pin 8	3.8V	3.8V[7]	3.8V[7]	3.8V	3.8V
U14 pin 11	3.8V	3.8V[8]	0.1V[8]	3.8V	3.8V
U3 pin 6	3.8V	3.8V	3.8V	Waveform A Vpp = 3.8	Waveform A Vpp = 3.8
U7 pin 3	0.1V	2.3V[6]	3.1V[6]	Waveform A Vpp = 2.3	Waveform A Vpp = 2.9
U7 pin 5	0.1V	2.3V[5]	3.1V[5]	Waveform A Vpp = 2.3	Waveform A Vpp = 2.9
P5-3 (IN-)	8.8V	7.6V	6.9V	7.5V	7.0V
TP2 (SPEED)	8.8V	7.6V	12.2V	7.5V	12.2V
P2-4 (MTR FWD)	10.8V	7.7V[5]	12.1V[5]	Waveform A Vpp = 7.0	Waveform A Vpp = 11.5
P2-5 (MTR REV)	10.8V	7.7V[6]	12.1V[6]	Waveform A Vpp = 7.0	Waveform A Vpp = 11.5
P2-7 (LP)	12.7V	12.7V	12.7V	12.7V	12.7V
U10 pin 3	8.9V	8.9V	8.9V	8.9V	8.9V
U14 pin 6	0.1V	0.1V	0.1V	4.9V	4.9V
U14 pin 3	4.9V	4.9V	4.9V	0.1V	0.1V
U17 pin 3	4.4V	4.4V	4.4V	Waveform A Vpp = 2.3V	Waveform A Vpp = 2.3V
U18 pin 3	0.1V	0.1V	0.1V	Waveform A Vpp = 2.3	Waveform A Vpp = 2.3
TP3	2.8V	2.8V	2.8V	2.8V	2.8V
U4 pin 5	0.1V	except when a switch is pressed on any handiece or footswitch then a single pulse as in Waveform B			


577 msec
Vpp
1.11 sec
4.0V
15 msec

Waveform A

Waveform B

Figure 3-11. Test points.

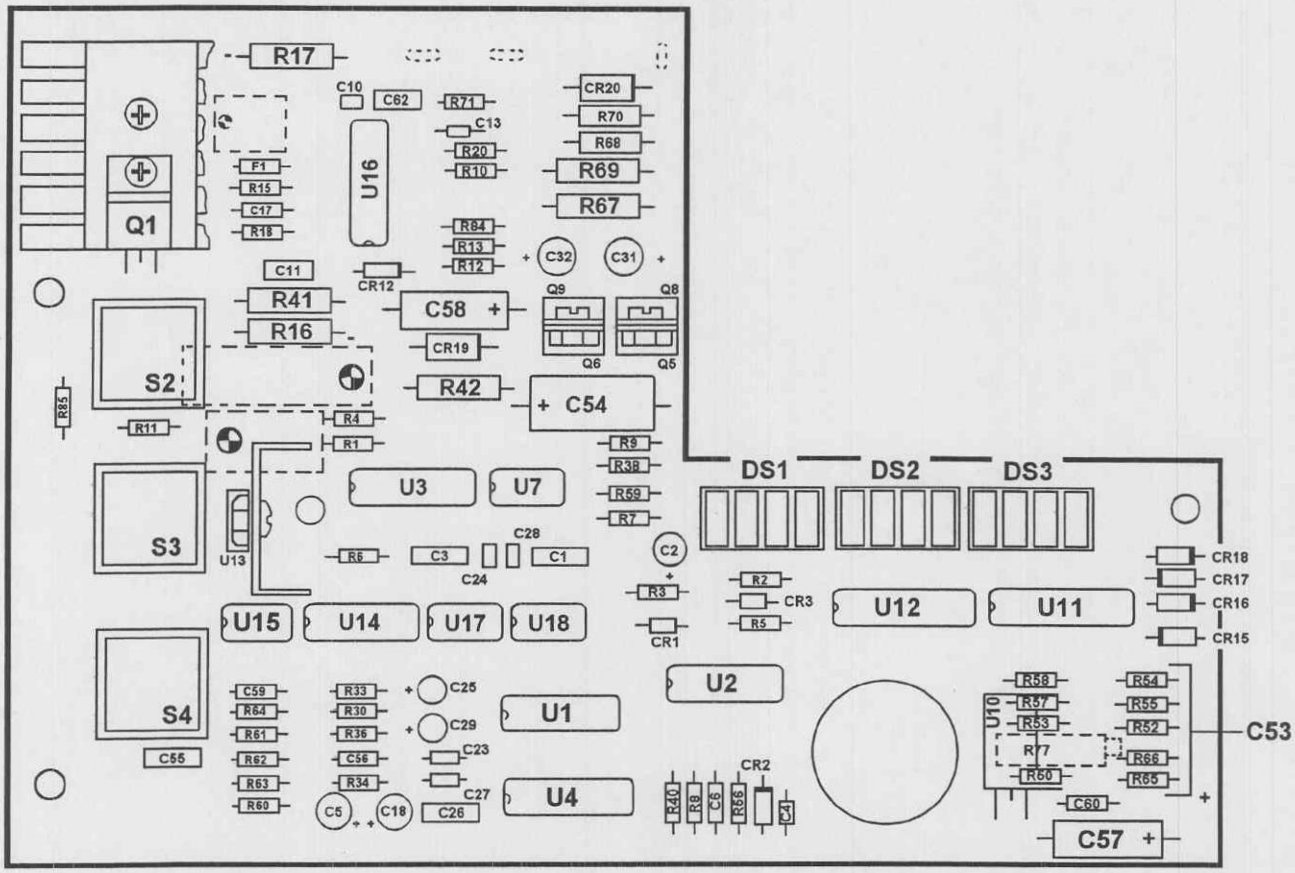

R17
C10
C62
R71
C13
R20
R10
CR20
R70
R68
R69
R67
U16
F1
R15
C17
R18
Q1
R84
R13
R12
C32
C31
C11
CR12
R41
R16
C58
CR19
Q9
Q8
Q6
Q5
S2
R42
C54
R85
R11
R4
R1
R9
R38
R59
R7
U3
U7
DS1
DS2
DS3
S3
U13
R6
C3
C28
C1
C24
C2
R2
R3
CR3
R5
CR1
U12
U11
CR18
CR17
CR16
CR15
U15
U14
U17
U18
S4
C59
R64
R61
R62
R63
R60
C55
R33
R30
R36
C56
R34
C25
C29
C23
C27
C5
C18
C26
U1
U2
U4
R40
R8
C6
R66
C4
CR2
U10
R58
R57
R53
R77
R50
R54
R55
R52
R66
R65
C53
C60
C57

Figure 3-12. Component layout - control PCB.

Section X. REPAIR PROCEDURES

3-35. General.

a. Procedures for disassembly, repair or replacement of components, services, and reassembly are provided in the manufacturer maintenance instructions and in the manufacturer electrical and mechanical assembly detail documents identified in Appendix A.

b. Refer to the operating information and operational tests in previous paragraphs to preclude unnecessary disassembly of the APS.

Section XI. STORING AND SHIPPING PROCEDURES

3-36. Preparation for storing.

a. Shut-down the APS by following the procedures in paragraph 2-10.

b. Fully charge the battery.

c. Disconnect the footswitch and handpiece.

d. Coil the footswitch and handpiece cords and then insert them in their storage location in the carrying case.

e. Inventory the components and accessories and either replace or requisition unserviceable or missing items.

f. Close and latch the carrying case.

g. Place the carrying case and other accessories (refer to paragraph 2-2) into the shipping case.

h. Close and latch the shipping case and move it to its storage location.

3-37. Preparation for shipping.

a. The APS packed in the carrying case and then the shipping container is suitable for shipping.

b. Notify your unit transportation point for assistance, if necessary.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. GENERAL INFORMATION

4-1. Overview.

This chapter provides for maintenance that is beyond the capability, capacity, and authorization for unit level maintenance personnel. The procedures in this chapter should not be attempted at the unit level.

4-2. Tools and test equipment.

Common tools and test equipment required for support maintenance of the equipment are listed in appendix B, section III. Refer to your unit's MTOE or installation table of distribution and allowances (TDA) for authorized items.

4-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III.

4-4. Expendable supplies.

Expendable and durable supplies and materials for support maintenance are listed in appendix D, section II.

4-5. Repair parts.

Repair parts required for support maintenance are listed in appendix E, section II.

4-6. Special tools.

Special tools required for support maintenance are listed in appendix E, section III.

Section II. MAINTENANCE PROCEDURES

4-7. General.

There are no specific troubleshooting procedures for DS/GS levels of maintenance.

APPENDIX A

REFERENCES

A-1. Army regulations.

AR 40-61	Medical Logistics Policies and Procedures
AR 710-2	Supply Policy Below the Wholesale Level
AR 725-50	Requisitioning, Receipt, and Issue System
AR 750-1	Army Materiel Maintenance Policy and Retail Maintenance Operations

A-2. Technical manual.

TM-DPSC-6500-RPL	Medical Materiel: Medical Repair Parts Reference List

A-3. Technical bulletins.

TB MED 7	Maintenance Expenditure Limits for Medical Materiel
TB 8-6500-MPL	Mandatory Parts List for Medical Equipment
TB 38-750-2	Maintenance Management Procedures for Medical Equipment
AR 702-18/DLAR 4155.37/NAVSUP INST 4410.56/AFR 69-10/MCO 4450.13	Quality Control, Depot Storage Standards, Appendix M, Medical Supplies

A-4. Field manual.

FM 21-11	First Aid for Soldiers

A-5. Supply bulletin.

SB 8-75-( )-series	Army Medical Department Supply Information

A-6. Other publications.

(These publications may be obtained from U.S. Army Medical Materiel Agency, 1423 Sultan Drive, Suite 100, ATTN: MCMR-MMM, Fort Detrick, MD 21702-5001.)

Operating Instructions (September 1990), Zimmer, Inc., Hall Surgical Division, Carpinteria, CA 93013.

Maintenance Instructions (September 1990), Zimmer, Inc., Hall Surgical Division, Carpinteria, CA 93013.

Appendix A, Electrical and Mechanical Assembly Detail Documents (undated), Zimmer, Inc., Hall Surgical Division, Carpinteria, CA 93013.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance levels.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions, explanatory notes, and/or illustrations required for a particular maintenance function.

B-2. Explanation of columns in section II.

a. Group Number, Column 1. The assembly group number (Group No.) column is a numerical group assigned to each assembly. The applicable assembly groups are listed in the maintenance allocation chart (MAC) in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group, Column 2. This column contains a brief description of the components of each assembly group.

c. Maintenance Functions, Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

C - Operator or crew

O - Unit maintenance

F - Direct support maintenance

H - General support maintenance

D - Depot maintenance

The maintenance functions are defined as follows:

A - Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B - Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C - Service. To clean, to preserve, to charge, and to add lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

D - Adjust. To rectify to the extent necessary to bring into proper operating range.

E - Align. To adjust specified variable elements of an item to bring it to optimum performance.

F - Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G - Install. To set for use in an operational environment such as tents or International Standards Organization shelters.

H - Replace. To replace unserviceable items with serviceable like items.

I - Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage to a specific failure. Repair may be accomplished at each level of maintenance.

J - Overhaul. Normally the highest degree of maintenance performed by the Army in order to minimize time work in process consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by a maintenance standard in technical publications for each item of equipment. Overhaul normally does not return an item to like new condition.

K - Rebuild. The highest degree of material maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance level.

d. Tools and Equipment, Column 4. This column is provided for referencing by code, the tools and test equipment (sec III) required to perform the maintenance functions.

e. Remarks, Column 5. This column is provided for referencing by code, the remarks (sec IV) pertinent to the maintenance functions.

B-3. Explanation of columns in section III.

a. Reference Code, Column 1. This column correlates to section II, column 4.

b. Maintenance Level, Column 2. This column identifies the maintenance levels using the tools and test equipment.

c. Nomenclature, Column 3. This column identifies the tools and test equipment.

d. National Stock Number, Column 4. This column provides the national stock number (NSN) of the specific tools or test equipment.

B-4. Explanation of columns in section IV.

a. Reference Code, Column 1. This column correlates to section II, column 5.

b. Remarks, Column 2. This column provides supplemental information or explanatory notes pertinent to the maintenance function in section II.

Section II. MAINTENANCE ALLOCATION CHART FOR ARTHROSCOPIC SURGICAL UNIT

(1) GROUP NO.	(2) ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS A	B	C	D	E	F	G	H	I	J	K	(4) TOOLS AND EQUIPMENT	(5) REMARKS
00	Arthroscopic Unit	O 0.5												A
01	Battery 12V		O 0.3	O 0.3					O 0.4				01,02,03	A
02	Battery Charger	O 0.1	O 0.1						O 0.5				01,02,03, 05	A
03	Control Power Supply Board Assembly		F 0.5						O 1.0	F 1.5			01,02,03 04,05	A
04	Switch ON/OFF	O 0.1	O 0.1						O 0.5				01,02,03	A
05	Switch Momentary	O 0.1	O 0.1						O 0.5				01,02,03	A
06	AC Power Supply Board		F 0.5						O 1.0	F 1.5			01,02,03 04,05	A
07	Power Supply Selector or Board Assembly	O 0.1	O 0.5						O 1.0	F 1.5			01,02,03 04,05	A
08	Power Supply Switch Board Assembly	O 0.1	O 0.5						O 0.5	F 1.0			01,02,03 04,05	A
09	Harness Power Supply Handpiece	O 0.1	O 0.1						O 0.1				01,02,03	A
10	Harness Ballwire	O 0.1	O 0.1						O 0.1				01	A
11	Harness Foot Control	O 0.1	O 0.1						O 0.1				01,02,03	A
12	Handpiece High Speed	O 0.1	O 0.2						O 0.5				01,02,03	A
13	Handpiece Low Speed	O 0.1	O 0.2						O 0.5				01,02,03	A

Section III. TOOLS AND TEST EQUIPMENT FOR ARTHROSCOPIC SURGICAL UNIT

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER
01	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Repairmans	5180-00-611-7923
02	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Organizational	5180-00-611-7924
03	O,F,H,D	Multimeter, UN/USM 486 or Multimeter, AN/PSM 45A	6625-01-145-2430 6625-01-265-6000
04	O,F,H,D	Oscilloscope, OS291/G	6625-01-258-0022
05	O,F,H,D	Test Set, Electronic Circuit	6625-01-255-0839

Section IV. REMARKS FOR ARTHROSCOPIC SURGICAL UNIT

(1) REFERENCE CODE	(2) REMARKS
A	Tools and test equipment are listed for each assembly group.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope.

This appendix lists components of end item and basic issue items for the equipment to help you inventory items required for safe and efficient operation.

C-2. General.

The Components of End Item and Basic Issue Items lists are divided into the following sections:

a. Section II. Components of End Item. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the equipment in operation, to operate it, and to perform emergency repairs. Basic issue items must be with the equipment during operation and whenever it is transferred between property accounts. This manual is your authority to request or requisition basic issue items, based on MTOE authorization of the end item.

C-3. Explanation of columns.

The following provides an explanation of columns found in both listings:

a. Item Number, Column 1. This column indicates the item number assigned to the item.

b. National Stock Number, Column 2. This column indicates the national stock number assigned to the item.

c. Description, Column 3. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the commercial and government entity (CAGE) code in parentheses followed by the part number.

d. Unit of Measure, Column 4. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.

e. Quantity, Column 5. This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. COMPONENTS OF END ITEM FOR ARTHROSCOPIC SURGICAL UNIT

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1		Handpiece, Low Speed (1HS04) 15-3901-001-00	EA	1
2		Handpiece, High Speed (1HS04) 15-3930-001-00	EA	1
3		Footswitch (1HS04) 00-5039-028-00	EA	1
4		Battery 12V, Lead Acid (1HS04) 22-6320-000-00	EA	1

Section III. BASIC ISSUE ITEMS FOR ARTHROSCOPIC SURGICAL UNIT

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1		Operating and Instruction Manual (1HS04) None	EA	2
2		Maintenance and Instruction Manual (1HS04) None	EA	2
3		Arthroscopic Cannula, 40 mm (1HS04) 5039-37	PG	2
4		Arthroscopic Cannula, 25 mm (1HS04) 5039-36	PG	2
5		Arthroscopic Cannula, 75 mm (1HS04) 5039-38	PG	2
6		Case (1HS04) None	EA	1
7	6515-01-167-3787	Blade Assembly Cutter, 3.5 mm (25471) None	EA	3
8	6515-01-168-3780	Blade Assembly Cutter, 4.5 mm (25471) None	EA	3
9	6515-01-168-3779	Blade Assembly Trimmer, 3.5 mm (25471) None	EA	3
10	6515-01-167-3786	Blade Assembly Trimmer, 4.5 mm (25471) None	EA	2
11		Brush Cleaning Cannula (1HS04) None	EA	2
12	6530-01-169-5926	Tray, Sterilization (25471) 2684	EA	1

APPENDIX D

EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. Scope.

This appendix lists expendable and durable supplies and materials that are required to maintain the equipment. This listing is authorization to requisition and retain the items if not otherwise authorized.

D-2. Explanation of columns.

a. Item Number, Column 1. The item number (Item No.) is sequentially assigned.

b. Level, Column 2. This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. National Stock Number, Column 3. This column indicates the national stock number assigned to the item.

d. Description, Column 4. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

e. Unit of Measure, Column 5. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by an alphabetical abbreviation. These abbreviations are listed in the glossary.

f. Quantity, Column 6. This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) UNIT OF MEASURE	(6) QTY
1	O	7920-01-004-7847	Cloth, Cleaning (97327) Rymple Cloth 301	RO	1
2	O	4940-01-087-3468	Workstation ESO Control (12038) 4560901	EA	1
			or		
		4940-01-250-4236	Workstation ESO Control (81349) MIL-W-87893-30	EA	1
			or		
		5920-01-253-5368	Workstation ESO Control (12038) ASGK-MIL	EA	1
3	O	6505-00-655-8366	Alcohol, Isopropyl	PT	1

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

E-1. Scope.

This manual lists spare and repair parts, special tools, special test equipment; and other special support equipment required for the performance of unit level, direct support, general support, and depot level maintenance. It authorizes the requisitioning and issue of spare and repair parts in consonance with the MAC (appendix B).

E-2. General.

The Repair Parts and Special Tools List is divided into the following sections:

a. Repair Parts, Section II. A list of repair parts authorized for the performance of maintenance in figure number and item number sequence.

b. Special Tools, Test, and Support Equipment, Section III. A list of special tools, test, and support equipment authorized for the performance of maintenance.

E-3. Explanation of columns in section II.

a. Illustration, Column 1.

(1) *Figure Number.* This column indicates the figure number (FIG NO.) of the illustration on which the item is shown.

(2) *Item Number.* This column indicates the item number (ITEM NO.) used to identify each item on the illustration.

b. National Stock Number, Column 2. This column indicates the national stock number assigned to the item.

c. Description, Column 3. This column indicates the federal item name of the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

d. Unit of Measure, Column 4. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

e. Quantity, Column 5. This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

E-4. Explanation of columns in section III.

a. Item Number, Column 1. This number is sequentially assigned.

b. Level, Column 2. This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. National Stock Number, Column 3. This column indicates the national stock number assigned to the item.

d. Description, Column 4. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

e. Unit of Measure, Column 5. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

f. Quantity, Column 6. This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

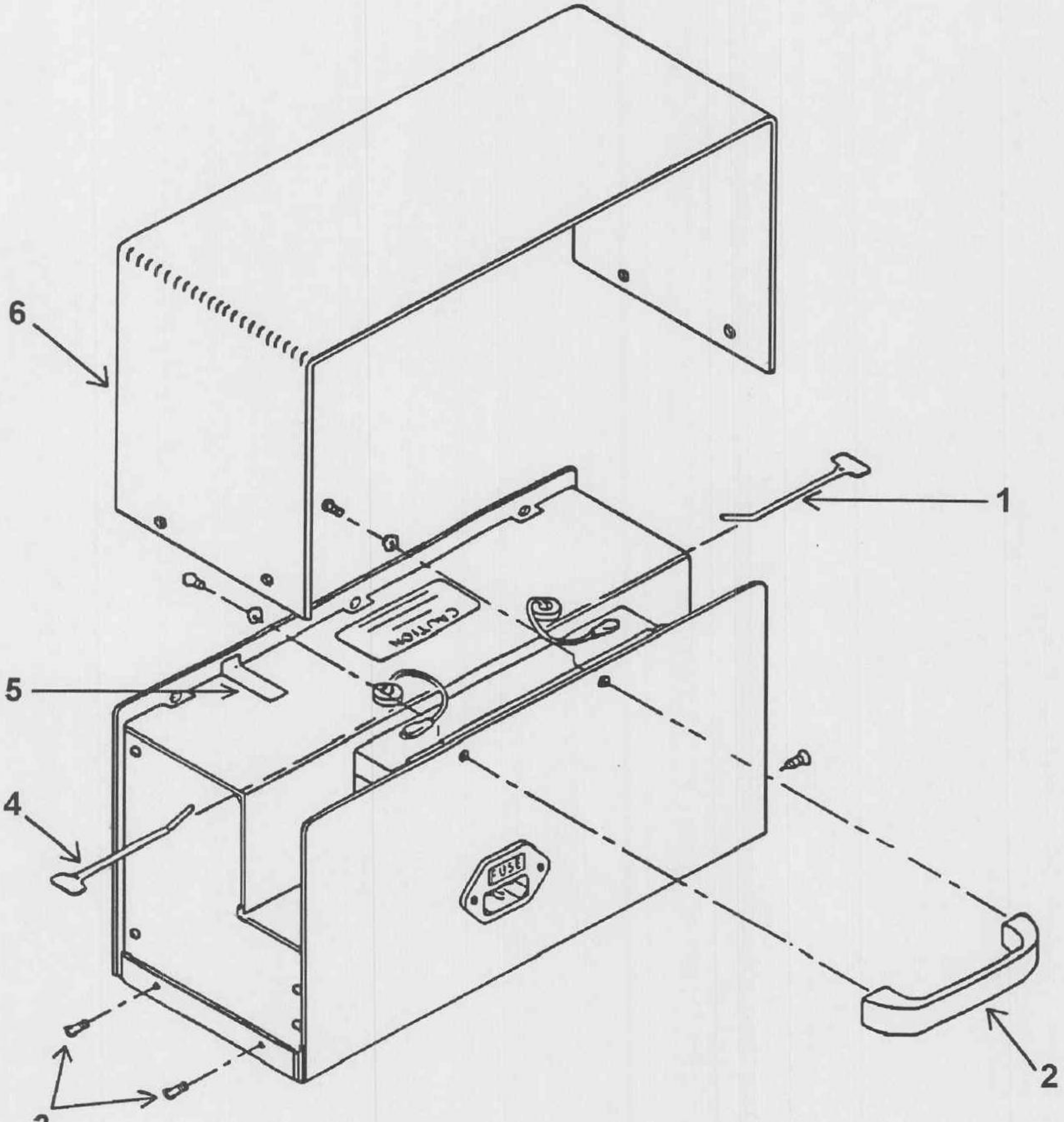

6
1
CAUTION
5
FUSE
4
2
3

Figure E-1. Console top cover disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	1		Wire Tie Black (1HS04) 22-6377-01-00	EA	1
E-1	2		Handle (1HS04) 22-6325-001-00	EA	1
E-1	3		Screws (1HS04) 22-6329-000-00	EA	1
E-1	4		Wire Tie Red (1HS04) 22-6377-02-00	EA	1
E-1	5		Warranty Tag (1HS04)	EA	1
E-1	6		Power Supply Cover (1HS04) 22-16699-00-00	EA	1

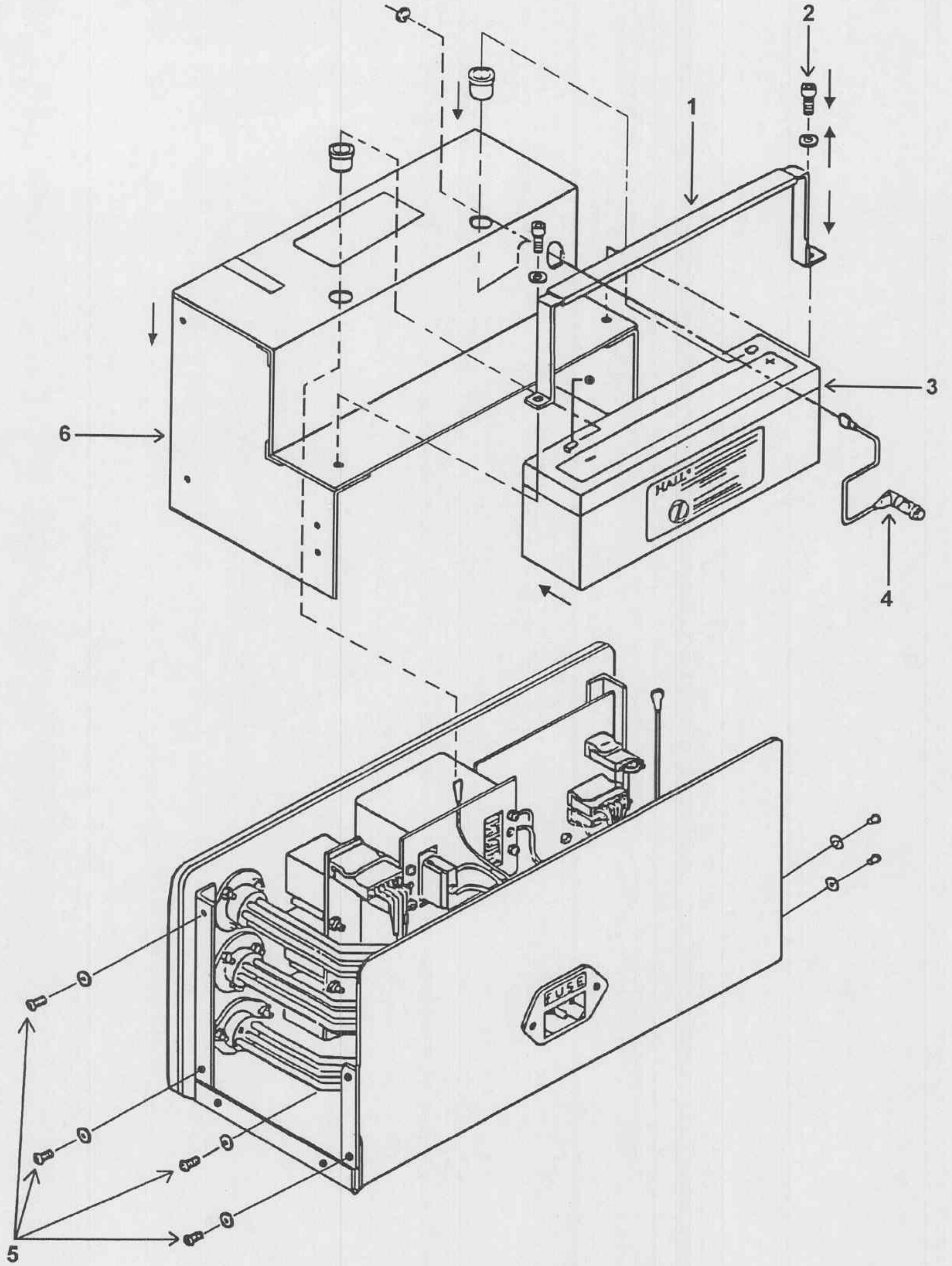

2
1
3
6
4
HALL
FUSE
5

Figure E-2. Console battery and inner cover disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-2	1		Battery Bracket (1HS04) 22-15925-00-00	EA	1
E-2	2		Screw (1HS04) 22-6321-000-00	EA	2
E-2	3		Battery 12V Lead Acid (1HS04) 22-6320-000-00	EA	1
E-2	4		Fuse Assembly Battery Power Supply (1HS04) 15-3922-305-00	EA	1
E-2	5		Electronic Safety Screw (1HS04) 22-6323-000-00	EA	4
E-2	6		Electronic Cover (1HS04) 22-16698-00-00	EA	1

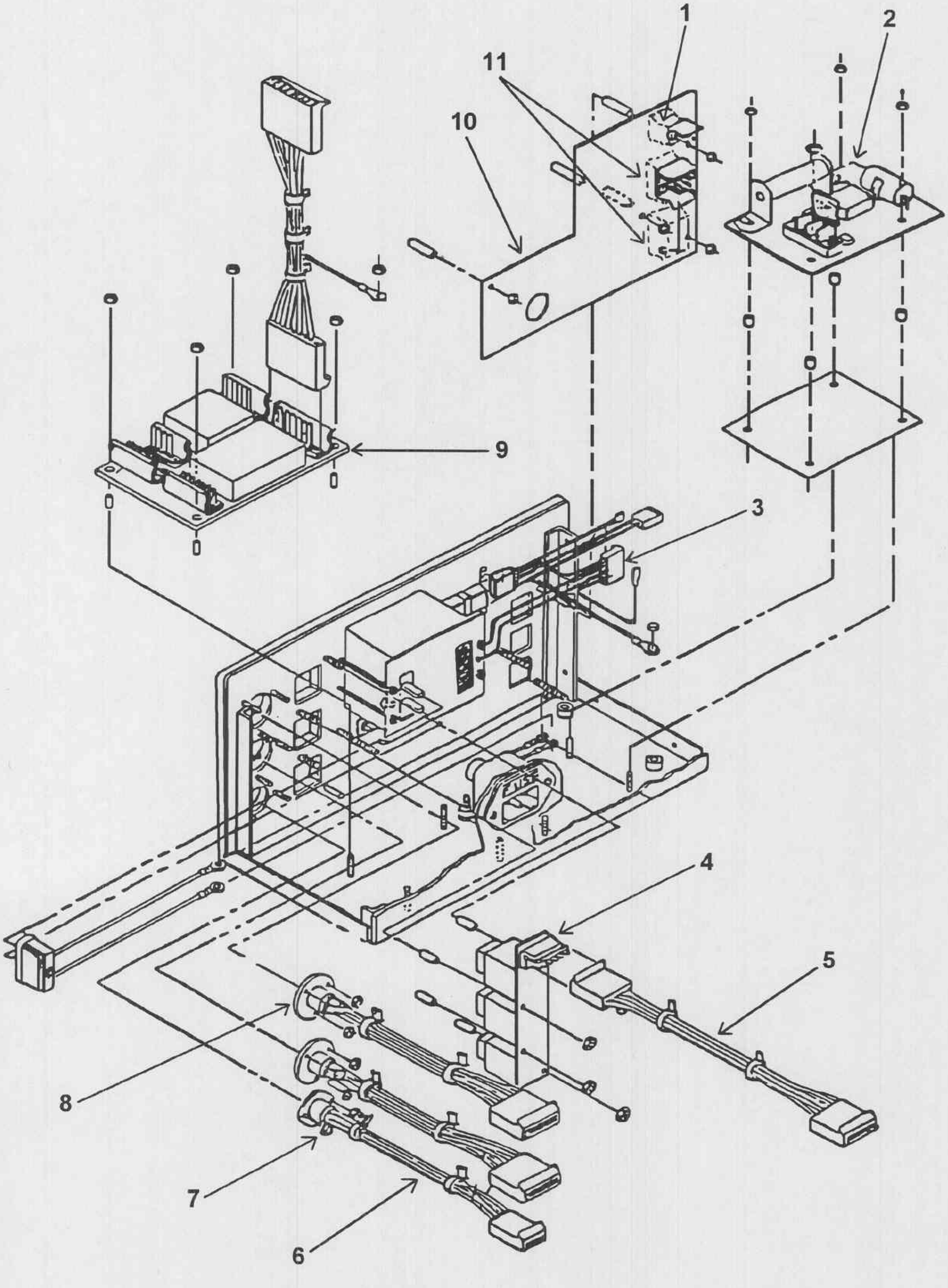

1
2
11
10
9
3
4
5
8
7
6

Figure E-3. Console wire harness and circuit cards disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-3	1		ALT Latch Switch (1HS04) 22-6289-002-00	EA	1
E-3	2		Board Assembly AC Power Supply (1HS04) 15-3902-290-00	EA	1
E-3	3		Ball Harness Assembly (1HS04) 15-3922-300-00	EA	1
E-3	4		Board Assembly Power Supply Switch (1HS04) 15-3922-298-00	EA	1
E-3	5		Wire Harness (1HS04) 15-3922-303-00	EA	1
E-3	6		Harness, Power Supply Footswitch (1HS04) 15-3922-302-00	EA	1
E-3	7		Retainers (1HS04) 22-16765-00	EA	1
E-3	8		Harness, Power Supply Handpiece (1HS04) 15-3922-301-00	EA	1
E-3	9		Board Assembly, Power Supply Selector (1HS04) 15-3922-297-00	EA	1
E-3	10		Board Assembly, Control Power Supply (1HS04) 15-3922-296-00	EA	1
E-3	11		Momentary Switch (1HS04) 22-6289-001-00	EA	1

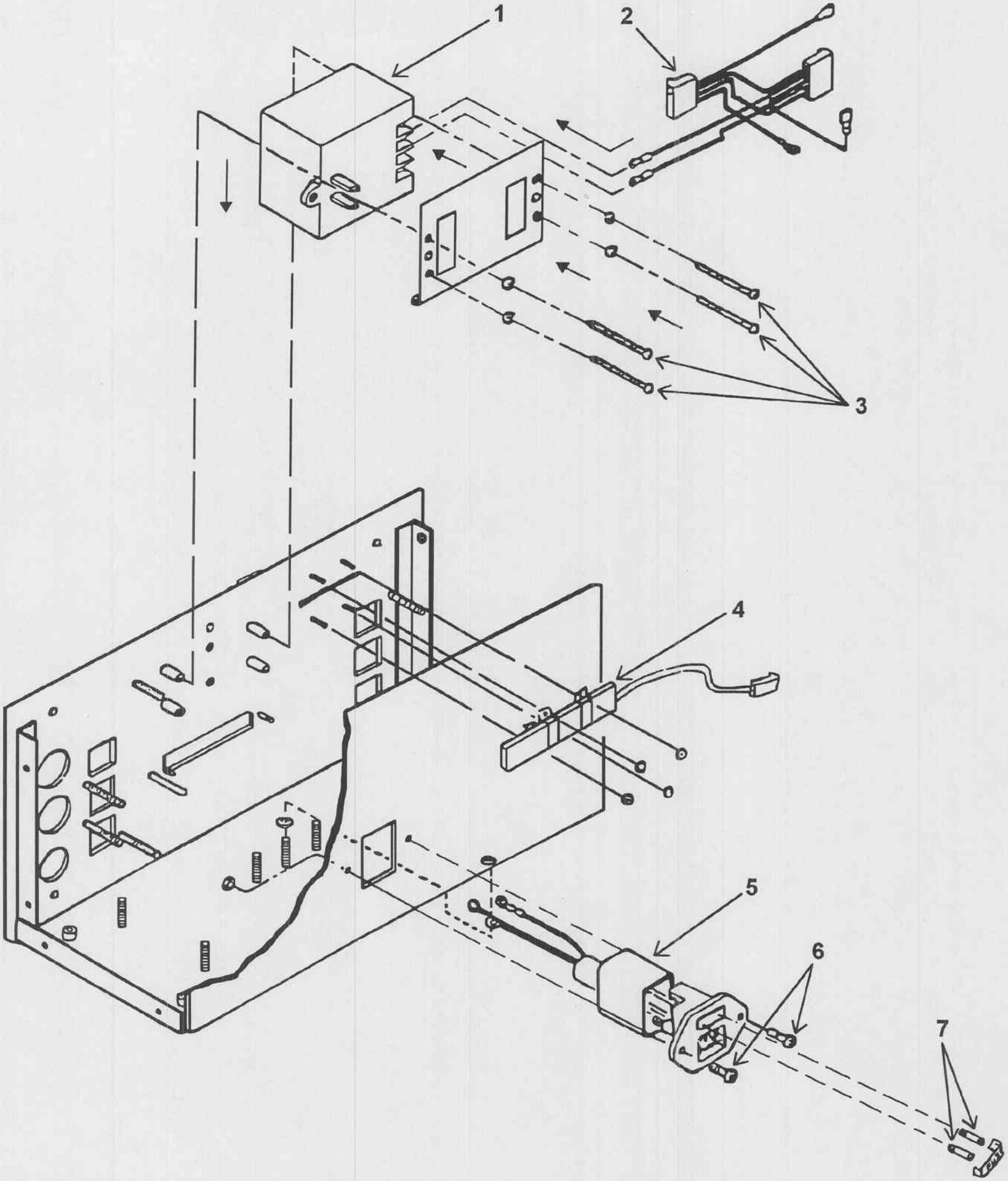


Figure E-4. Console battery charger disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-4	1		Charger, Battery Power Supply (1HS04) 22-6316-000-00	EA	1
E-4	2		Harness, Power Supply (1HS04) 15-3922-300-00	EA	1
E-4	3		Screw (1HS04) 22-6317-000-00	EA	4
E-4	4		Control Assembly Power Supply (1HS04) 15-3922-034-00	EA	1
E-4	5		AC Tub Assembly (1HS04) 15-3922-031-00	EA	1
E-4	6		Screw (1HS04) 22-6744-000-00	EA	2
E-4	7		Fused Tub Assembly (1HS04) 22-6715-000-00	EA	2

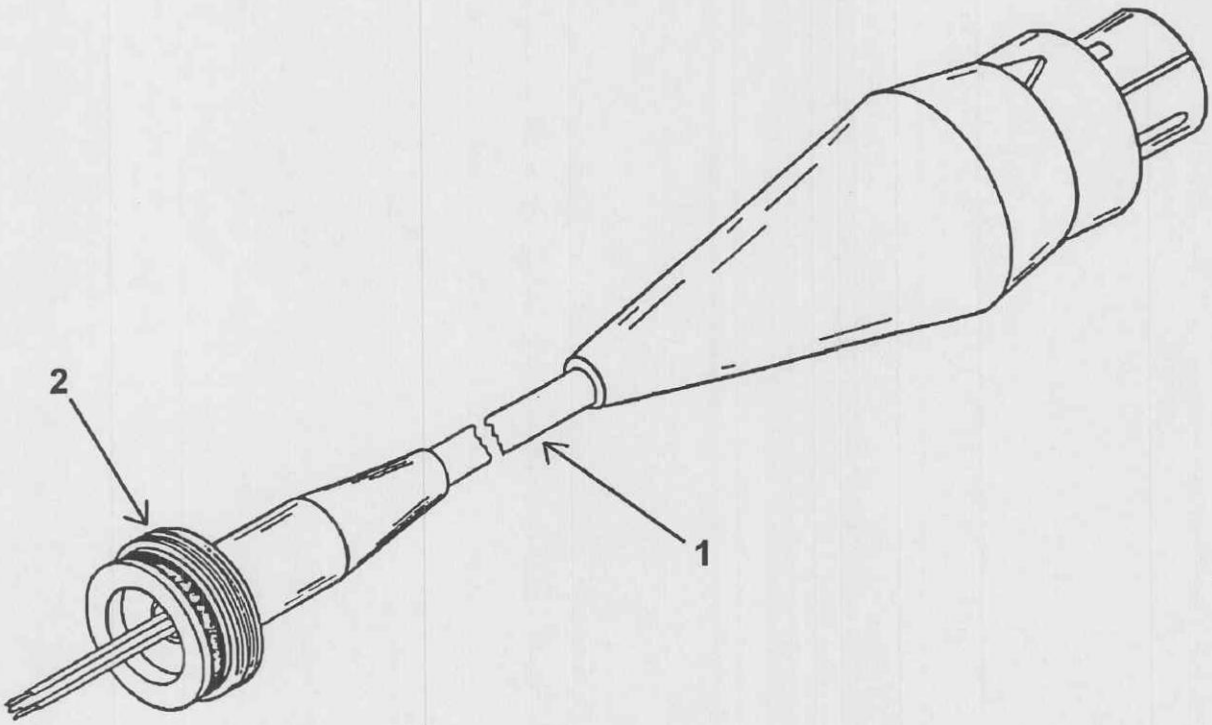


Figure E-5. Handpiece end cap retainer disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2)	(3)	(4)	(5)
FIG NO.	ITEM NO.	NATIONAL STOCK NUMBER	DESCRIPTION	UNIT OF MEASURE	QTY
E-5	1		Cord Assembly, Handpiece (1HS04) 15-3926-028-00	EA	1
E-5	2		End Cap Retainer (1HS04) 22-1593-00-00	EA	1

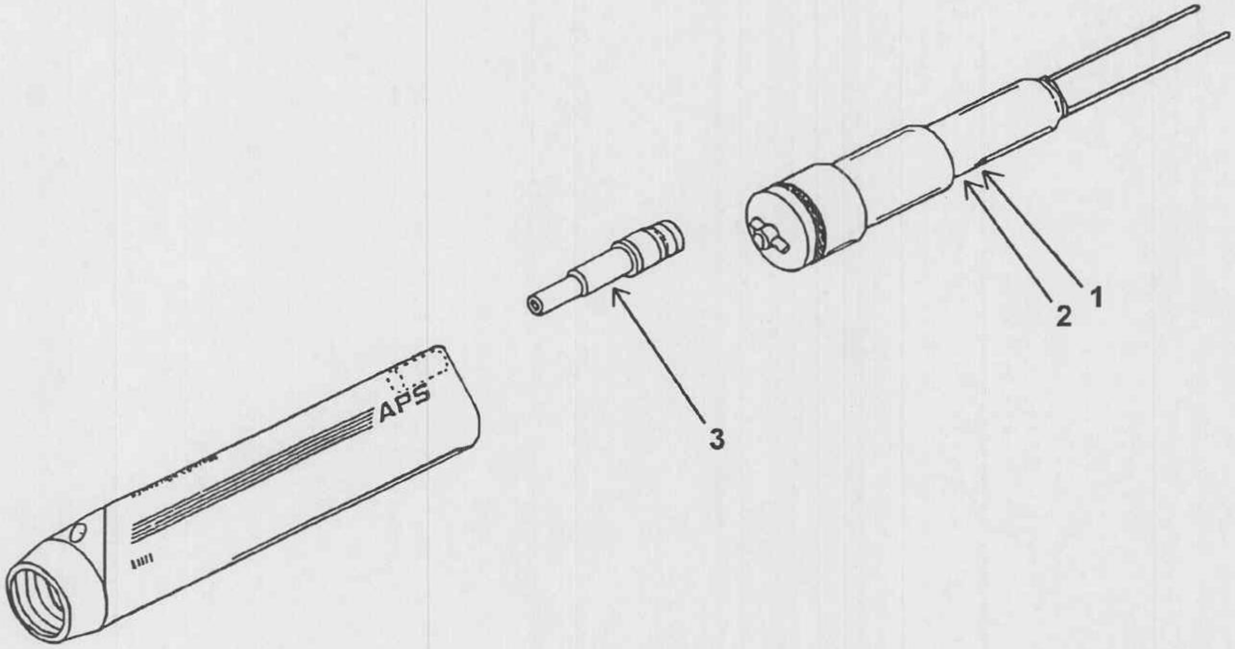


Figure E-6. Handpiece motor and aspiration control disassembly/assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-6	1		Motor Assembly, Low Speed Handpiece (1HS04) 15-3901-001-00	EA	1
E-6	2		Motor Assembly, High Speed Handpiece (1HS04) 15-3930-001-00	EA	1
E-6	3		Connector, Handpiece Aspiration (1HS04) 22-15914-01-00	EA	1

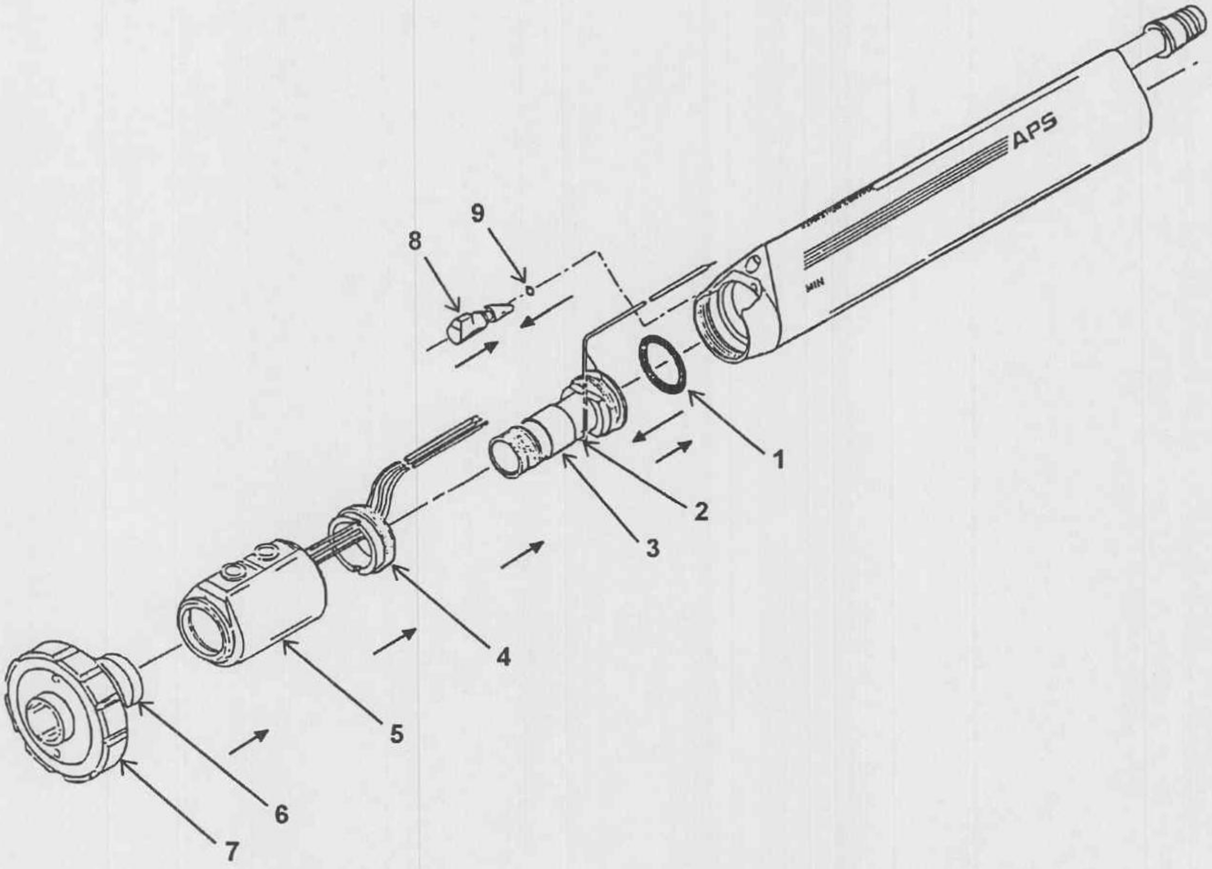

9
8
APS
MIN
1
2
3
4
5
6
7

Figure E-7. Handpiece trigger and nosepiece disassembly/assembly.

Section III. REPAIR PARTS LIST
FOR
ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2)	(3)	(4)	(5)
FIG NO.	ITEM NO.	NATIONAL STOCK NUMBER	DESCRIPTION	UNIT OF MEASURE	QTY
E-7	1		O-Ring, Handpiece Trigger (1HS04) 22-5312-000-00	EA	1
E-7	2		Mount Assembly, Handpiece Switch (1HS04) 15-3901-035-00	EA	1
E-7	3		Solder Joint (1HS04) N/A	EA	1
E-7	4		Switch, Mount Nut (1HS04) 22-15918-00-00	EA	1
E-7	5		Trigger Assembly (1HS04) 15-3901-005-00	EA	1
E-7	6		Hydraulic Sealant (1HS04) N/A	EA	1
E-7	7		Nose Assembly (1HS04) 15-3901-010-00	EA	1
E-7	8		Valve, Handpiece Aspiration (1HS04) 22-15915-00-00	EA	1
E-7	9		O-Ring Handpiece (1HS04) 22-6589-000-00	EA	1

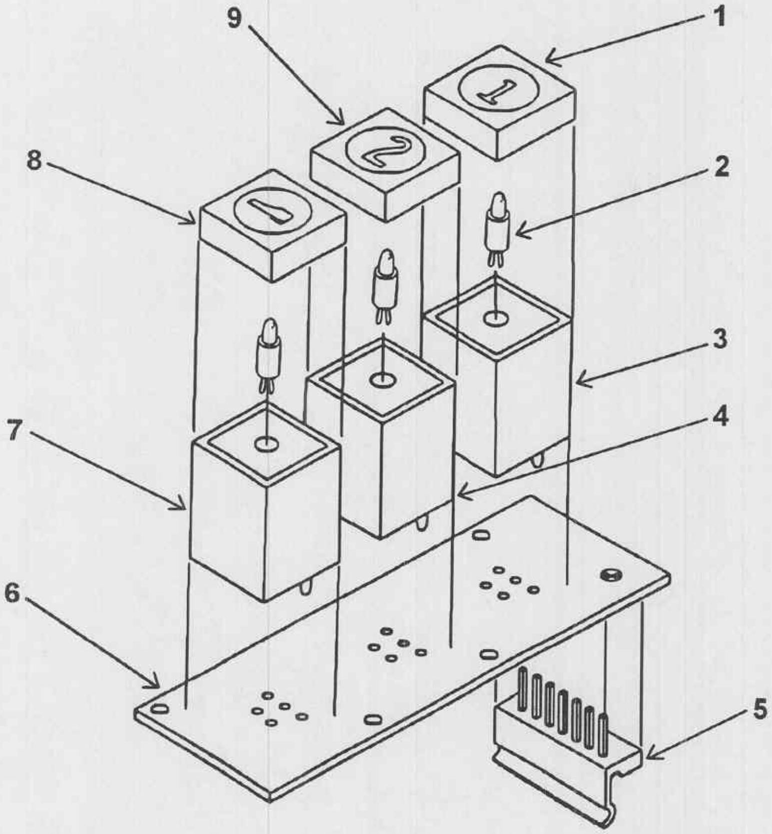


Figure E-8. PCB assembly switches.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-8	1		Lens (1HS04) 22-16702-01-00	EA	1
E-8	2		Lamp (1HS04) 22-16954-00-00	EA	3
E-8	3		Switch, Momentary (1HS04) 6289-03	EA	1
E-8	4		Switch, Momentary (1HS04) 6289-03	EA	1
E-8	5		Connector (1HS04) 6359	EA	1
E-8	6		Switch, PCB (1HS04) 22-16877-00-00	EA	1
E-8	7		Switch, Alternate (1HS04) 6289-04	EA	1
E-8	8		Lens, Foot (1HS04) 22-16702-04-00	EA	1
E-8	9		Lens (1HS04) 22-16702-02-00	EA	1

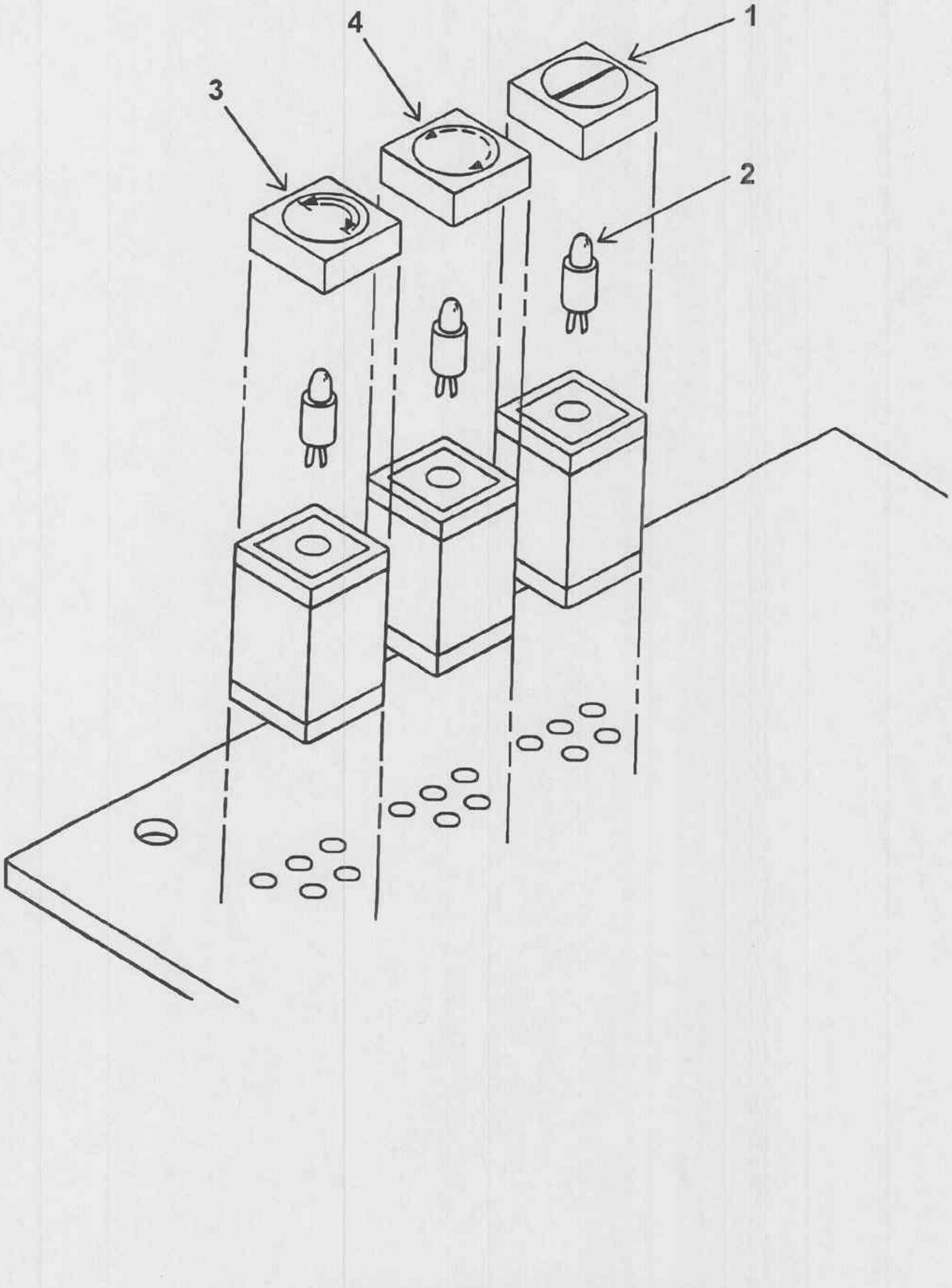


Figure E-9. Lamp assembly control board.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2)	(3)	(4)	(5)
FIG NO.	ITEM NO.	NATIONAL STOCK NUMBER	DESCRIPTION	UNIT OF MEASURE	QTY
E-9	1		Lens, Power (1HS04) 22-16702-03-00	EA	1
E-9	2		Lamp (1HS04) 22-16954-00-00	EA	3
E-9	3		Lens, Oscillate (1HS04) 22-16702-06-00	EA	1
E-9	4		Lens, Rotate (1HS04) 22-16702-05-00	EA	1

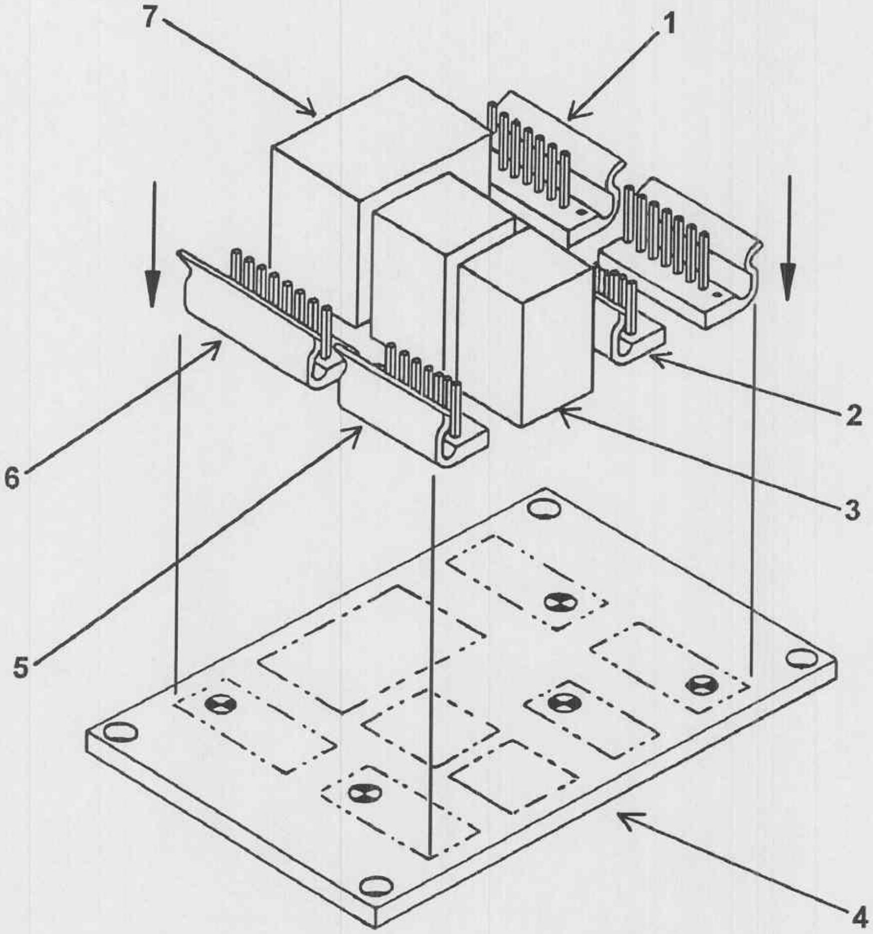


Figure E-10. Selection board assembly.

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2)	(3)	(4)	(5)
FIG NO.	ITEM NO.	NATIONAL STOCK NUMBER	DESCRIPTION	UNIT OF MEASURE	QTY
E-10	1		Connector, Wafer, 8 Pin (1HS04) 22-6722-000-00	EA	2
E-10	2		Connector, Wafer, 5 Pin (1HS04) 22-6721-000-00	EA	1
E-10	3		Relay, 2 Pole (1HS04) 22-6782-000-00	EA	2
E-10	4		Selection PCB (1HS04) 22-16961-00-00	EA	1
E-10	5		Connector, Wafer, 7 Pin (1HS04) 22-6359-000-00	EA	1
E-10	6		Connector, Wafer, 9 Pin (1HS04) 22-6723-000-00	EA	1
E-10	7		Relay, 4 Pole (1HS04) 22-6782-001-00	EA	1

Section III. REPAIR PARTS LIST FOR ARTHROSCOPIC SURGICAL UNIT

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				

THERE ARE NO SPECIAL TOOLS, TEST, OR SUPPORT EQUIPMENT APPLICABLE FOR THIS END ITEM.

GLOSSARY

AC	Alternating current
AFR	Air Force regulation
APS	Articular power system
AR	Army regulation
C	Operator or crew
CAGE	Commercial and government entity
cm	Centimeter
CVC	Calibration/verification/certification
°C	Degrees Celsius
°F	Degrees Fahrenheit
D	Depot level maintenance
DA	Department of the Army
DLA	Defense Logistics Agency
DLAM	Defense Logistics Agency manual
DPSC	Defense Personnel Support Center
DS	Direct support
EA	Each
F	Direct support maintenance
FIG (fig)	Figure
FM	Field manual
FS	Forward switch
g	Gram
GS	General support
H	General support maintenance
Hz	Hertz
in	Inch
ISO	International Standards Organization
kg	Kilogram
LED	Light emitting diode
MAC	Maintenance allocation chart
MAX	Maximum
MIN	Minimum
Mm	Millimeter
MPL	Mandatory parts list
MTOE	Modified table of organization and equipment
MTR FWD	Motor forward

MTR REV	Motor reverse
NO.	Number
nSec	Nano second
NSN	National stock number
O	Unit maintenance
OSM	Oscillating signal modulation
oz	Ounce
para	Paragraph
PCB	Printed circuit board
PG	Package
PMCS	Preventive maintenance checks and services
PT	Pint
QC	Quality control
QTY	Quantity
RO	Roll
RPL	Repair parts list
rpm	Revolutions per minute
RS	Reverse switch
SB	Supply bulletin
TB	Technical bulletin
TDA	Table of distribution and allowances
TM	Technical manual
V	Volts
VAC	Volts alternating current
VDC	Volts direct current
Vpp	Volts peak-peak

INDEX

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Maintenance Shop
Frederick, MD 21702

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 8-6515-010-14&P	6 Feb 88	Surgical Unit, Arthroscopic

BE EXACT. . PIN-POINT WHERE IT IS				
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-7	2-5			Change electrical cable to electrical assembly. REASON: Corrects nomenclature.
E-11		E-4		Reverse call-out numbers 4 and 8. REASON: Correctly identifies part.

SAMPLE

CUT ALONG PERFORATED LINE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, Maintenance Supervisor
DSN 343-XXXX

SIGN HERE
John Doe

DA FORM 1 JUL 79 2028-2

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PS --IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

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THEN. . JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 8-6515-010-14&P		Surgical Unit, Arthroscopic

BE EXACT. . PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

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REVERSE OF DA FORM 2028-2

CUT ALONG PERFORATED LINE

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

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OFFICIAL BUSINESS

Commander
U. S. Army Medical Materiel Agency
ATTN: MCMR-MMM
1423 Sultan Dr., Suite 100
Fort Detrick, MD 21702-5001

METRIC SYSTEM CONVERSIONS

CHANGE	*TO*	*MULTIPLY*	*CHANGE*	*TO*	*MULTIPLY*
inches	centimeters	2.540	centimeters	inches	.394
feet	meters	.305	meters	feet	3.280
yards	meters	.914	meters	yards	1.094
sq inches	sq centimeters	6.451	sq centimeters	sq inches	.155
sq feet	sq meters	.093	sq meters	sq feet	10.764
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	milliliters	fluid ounces	.034
pints	liters	.473	liters	pints	2.113
quarts	liters	.946	liters	quarts	1.057
gallons	liters	3.785	liters	gallons	.264
ounces	grams	28.349	grams	ounces	.035
pounds	kilograms	.454	kilograms	pounds	2.205

TEMPERATURE CONVERSION

Degrees Fahrenheit to Degrees Celsius: (°F - 32) X .5555 = °C

Degrees Celsius to Degrees Fahrenheit: (°C X 1.8) + 32 = °F

WEIGHTS

1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds

CUBIC MEASURE

1 cu centimeter = 1000 cu millimeters = .06 cu inch
1 cu decimeter = 1000 cu centimeters = 61.02 cu inches
1 cu meter = 1000 cu decimeters = 35.31 cu feet

LINEAR MEASURE

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches

LIQUID MEASURE

1 centiliter = 10 milliliters = .34 fluid ounce
1 deciliter = 10 centiliters = 3.38 fluid ounces
1 liter = 10 deciliters = 33.81 fluid ounces